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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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81 ADMINISTRATION AND MANAGEMENT 1071

Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 1072

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS 1073

Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 1073

Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1074

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.

For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 1076

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1077

Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1077

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 1078

Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 1082

Includes cosmic radiation; and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 1083

Note: N.A. means that no abstracts were assigned to this category for this issue.

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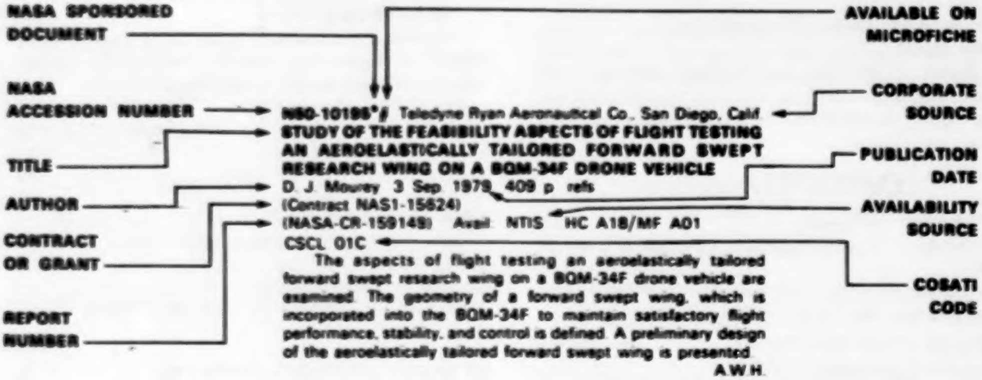
TYPICAL CITATION AND ABSTRACT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N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif.
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
D. J. Mourey 3 Sep. 1979 409 p refs
(Contract NAS1-15624)
(NASA-CR-159149) Avail: NTIS HC A18/MF A01
CSCL 01C

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.

A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects — not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, G-SEAT OPTIMIZATION

D.C. McGuire, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223950)

To investigate optimization of g-seat configurations, use of improved components, and software optimization.

A bench test set-up will be used to investigate hardware configurations, components, and adjustments. The configuration will include compressor, conoflow valve, booster valve, a g-seat bellow with instrumentation (potentiometer and accelerometer) and strip chart recorder. Software analysis will consist of organization and optimization by reducing unnecessary arrays, maximizing linear flow and eliminating unnecessary branching. The results will be applied to the g-seat systems of ASPT to improve their performance such as in lowered time constants, rise times, transport lags, and software execution time. Improved performance will make feasible emulation and evaluation on ASPT of new system design such as the A-10 simulator seat under development by Reflectone.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

1.0002, SUPERSONIC CRUISE/TRANSONIC MANEUVER WING SECTION DEVELOPMENT

C.D. Wiler, Rockwell International Corp., *International Airport, Los Angeles, California* (DF139870; F33615-77-C-3066)

Current advanced tactical aircraft missions include requirements for efficient supersonic cruise configurations capable of effective transonic maneuver. This effort is directed toward the application of advanced aerodynamic technologies in achieving such performance and represents a significant step toward the achievement of an improved force capability pending favorable results.

A wing design, which will include specification of thickness, camber, taper, and twist, will be evolved using analytical, design, and/or experimental techniques consistent with the current state of the art. Appropriate revolutionary configurations and approaches which represent advanced aerodynamic technologies will be incorporated into the design in order to overcome the aerodynamic configuration incompatabilities of the supersonic cruise and transonic maneuver flight regimes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0003, STUDIES IN ROTOR AERODYNAMICS AND NOISE

K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0004, FUNDAMENTAL STUDIES OF UNSTEADY TURBULENT BOUNDARY LAYERS

W.C. Reynolds, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (NCC 2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0005, NAVY VEHICLE DESIGN AND CONSTRUCTION - DEVELOPMENT OF HIGH-ANGLE-OF-ATTACK SYSTEM IDENTIFICATION TECHNOLOGY

W.E. Hall, Systems Control Inc., *260 Sheridan Ave., Palo Alto, California* 94306 (DN875586; N00014-78-C-0641)

System identification technology for use in flight testing aircraft has been developed in order to reduce flight test time and costs, and to improve the accuracy of flight test estimated aircraft characteristics. Initial applications have been limited to analysis of linear aircraft response at low angles of attack. During combat maneuvers, aircraft operate at high angles of attack where aerodynamic characteristics become highly nonlinear. The objective of this project is to develop the capability to quantify nonlinear stall/departure characteristics of high performance jet aircraft from flight test data using an advanced integrated approach to system identification.

Data are being obtained from a flight test program to expand the high-angle-of-attack envelope of F-4S aircraft. The program is being conducted in two phases. The first phase has been completed. The final phase will consist of high-angle-of-attack flight tests based on input design results, nonlinear model structure determination and verification, parameter identification to estimate nonlinear aerodynamic coefficients, development of an aerodynamic data base, and estimates of the F-4S airplane high-angle-of-attack departure boundaries.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0006, AERONAUTICAL TECHNOLOGY, TECH AREA M - AVIATION HUMAN ENGINEERING

I.C. Statler, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Aeromechanics Lab., *Moffett Field, California* 94035 (DA0D5001)

Improve Army air mobility systems by providing improved knowledge, criteria and technology for man-machine integration and by providing better engineering methods for performing the AVSCOM man-machine integration functions.

Systematic exploratory R&D in human performance technology, flight simulation methods and requirements, control and display technology, and man-machine dynamics. The approach emphasizes analytical and experimental studies using laboratory, simulation, mathematical modeling and flight test facilities. These activities have been coordinated with and will complement and support the handling qualities R&D of Tech Area A and the flight simulator development of Tech Area K. Objectives will be achieved largely through joint participation with NASA, making maximum use of the facilities and expertise available within NASA for man-machine systems research.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

1.0007, AERONAUTICAL TECHNOLOGY, TECH AREA K - FLIGHT SIMULATION

I.C. Statler, U.S. National Aeronautics & Space Admin., Ames Research Center, *Moffett Field, California* 94035 (DA0D5004)

Perform analyses and design studies to determine the requirements of a rotary-wing R&D flight simulator capable of simulating NOE flight operations. This effort complements the hardware development being conducted under 6.3, Project DB34.

In joint participation with NASA, perform the studies with the expectation of providing modifications and additions to an available NASA simulator to meet the Army's mission requirements.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

1.0008, COOPERATIVE GRADUATE PROGRAM IN THE FLIGHT SCIENCES

H. Liebowitz, George Washington University, School of Engineering & Applied Sciences, Dept. of Civil Mechanical & Environmental Engineering, *725 23rd St. N.W., Washington, District of Columbia* 20037 (NCC 1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0009, A NEW NUMERICAL APPROACH FOR COMPRESSIBLE VISCOUS FLOWS

J.C. Wu, Georgia Inst. of Technology, School of Aerospace Engineering, *Atlanta, Georgia* 30332 (NSG 3307)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0010, WING/NACELLE INTERFERENCE FLOW INVESTIGATION

J. Nagel, Iowa State University of Science & Technology, Graduate School, *Beardshear Hall, Ames, Iowa* 50010 (NCC 2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Headquarters

1.0011, DEVELOPMENT OF FINITE DIFFERENTIAL METHOD FOR INTERNAL COMPUTATIONAL FLUID MECHANICS

C.J. Chen, University of Iowa, School of Engineering, Dept. of Mechanical Engineering, *Jessup Hall, Iowa City, Iowa* 52240 (NSG 3305)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0012, AIR CUSHION SYSTEM TRUNK FLUTTER MODEL DEVELOPMENT

A.B. Boghani, Foster Miller Associates Inc., *135 2nd Ave., Waltham, Massachusetts* 02154 (DF141860; F33615-78-C-3412)

This effort supports the development of air cushion systems (ACS) for Air Force aircraft takeoff and landing. Under some ACS-equipped aircraft ground operating conditions, ACS trunks experience a flutter phenomenon which causes the aircraft to become dynamically unstable, introducing ground operation problems. The objective of this research study is to establish a better understanding of ACS trunk flutter and to develop an analytical technique for the evaluation of the flutter characteristics for ACS trunk designs. This technique will be applied for optimization and evaluation of ACS trunk designs to eliminate/minimize trunk flutter and to significantly improve ACS-equipped military aircraft ground operation.

Existing studies and test data will be analyzed to establish the principal variables and conditions causing ACS trunk flutter. Then, an analytical technique will be developed for evaluation of the flutter characteristics for ACS trunk designs. Next, the technique will be verified by its use to evaluate the flutter characteristics of the XC-8A aircraft's ACS trunk under various conditions. The results will be compared with flight test data. Initial ACS trunk design criteria will be developed for elimination of flutter and a final report prepared.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0013, DEVELOPMENT OF A METHODOLOGY FOR HORIZONTAL AXIS WIND TURBINE DYNAMIC ANALYSIS

R.H. Miller, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 3303)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0014, APPLICATION OF ADAPTIVE FINITE ELEMENT ANALYSIS OF INTEGRATED DESIGN AND ANALYSIS OF AIRCRAFT STRUCTURES

B.A. Szabo, Washington University, School of Engineering & Applied Science, Dept. of Civil Engineering, *4559 Scott Ave., St. Louis, Missouri* 63130 (NSG 1640)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0015, UNSTEADY TRANSONIC AERODYNAMICS OF CASCADES

E.H. Dowell, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Sciences, *Box 430, Princeton, New Jersey* 08540 (NSG 3292)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0016, THE INFLUENCE OF AUDITORY INPUTS ON SIMULATED FLIGHT OPERATIONS

E. Galanter, Columbia University, School of Arts & Sciences, Dept. of Psychology, *Broadway & W. 116th St., New York, New York* 10027 (NCC 1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0017, DEVELOPMENT OF ADVANCED FLIGHT CONTROL ACTUATION SYSTEM CONCEPTS FOR NAVY AIRCRAFT

J. Leonard, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN981062; N62269-78-C-0218)

The general objective of this task is to examine the broad spectrum of new flight control actuation concepts with respect to potential advantages and interrelationships with other aircraft systems. The resultant effect of these new concepts will be evaluated against projected aircraft mission and maintenance requirements. Recent advancements in on-board computers, electrical power equipment and solid-state processing components may offer advantages to new aircraft, especially with growing emphasis on combat survivability and simplified squadron maintenance. This contract supports work unit ZA601, Agency Accession No. DN 681080.

An investigation will be conducted to determine the feasibility of integrating an all-electric rotary actuator in a proposed aircraft. The investigation will determine potential benefits and design concepts for mechanization of such a system. A follow-on program may include development of hardware, testing and eventual flight demonstration.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0018, TRANSONIC WIND TUNNEL EXPERIMENTS ON OSCILLATING AIRFOILS

S.L. Petrie, Ohio State University Research Foundation, *1314 Kinnear Rd., Columbus, Ohio* 43212 (DF138650; AFOSR-76-3021)

This work unit supports the aeroelastic evaluation of high-speed aircraft. It will contribute to the development of improved unsteady aerodynamic methods to predict aircraft aeroelastic stability and structural dynamic response. The goal is to develop a low-cost research facility to conduct unsteady aerodynamic tests on oscillating models in transonic wind tunnels, resulting in ultimate savings in the costs to design new aircraft. The presence of a national capability to make these measurments will allow the orderly development of necessary analytical methods to optimize aircraft structures for minimum weight and cost.

A contractor will be selected to survey the ambient interference in a small transonic wind tunnel without a model present. An oscillating model will then be inserted into the tunnel and studies performed to determine Mach number, Reynolds number and wall interference effects on unsteady pressure measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, STRAIN GAGE ATTACHMENT TO COMPOSITES

J.L. Mullineaux, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141470)

This work unit supports the structural testing of aircraft components made from composites containing epoxy matrix material. The strength of the composite matrix is affected by a combination of elevated temperature and high humidity environments. Strain gage transducers can be used to determine the effects if the transducers are themselves impervious to the environment. This work unit will investigate techniques to obtain reliable data from strain gages installed on composite parts which are exposed to elevated temperature and humidity. The data from such transducers will greatly contribute to the flight safety of military aircraft.

This program will investigate non-epoxy adhesives as bonding agents and RTV silicon materials as coatings for strain gage installations on composites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0020, A STUDY OF INTERACTIVE AEROELASTIC AND AERODYNAMIC PROBLEMS RELATING TO GENERAL AVIATION PROPELLERS

B.W. McCormick, Pennsylvania State University, University Park Campus, School of Engineering, Dept. of Aerospace Engineering, *101 Hammond Bldg., University Park, Pennsylvania* 16802 (NSG 3304)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0021, STRUCTURAL DEGRADATION AND HAZARDS FROM HELICOPTER STRUCTURE EXPOSED TO FIRE AND/OR EXPLOSIONS (ABBREV)

R. Schiltz, Bell Helicopter Textron, *Hwy. 183, P.O. Box 482, Fort Worth, Texas* 76101 (DA0E3859; DAAK51 79 C 0009)

To investigate the effects of fire/explosion on the structural integrity of composite materials and the personnel hazards (toxicity, smoke, etc.) resulting from same.

Following a literature and organizational survey to establish design guidelines and requirements, composite specimens will be fabricated and laboratory tested to ascertain the structural degradation and resulting hazards (smoke, toxicity, etc.) to personnel when burning/explosion occurs. Based on the test findings, design guidelines will be developed to minimize the structural and personnel harmful effects due to composites exposed to post-crash, in-flight or explosive-induced fire. A computer program simulating the result of a helicopter composite structures fire will be demonstrated at ATL, Ft. Eustis, VA, upon completion of the technical effort.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0022, FORWARD SWEPT WING ANALYSIS

S.K. Hadley, General Dynamics Corp., *P.O. Box 748, Fort Worth, Texas* 76101 (DF140910; F33615-77-C-3133)

There are several planned approaches to improved performance of high-speed fighter aircraft in transonic maneuvering. Current deficiencies in this area indicate the need for major innovation to achieve large advantages in air combat maneuvering. One such innovation utilizes forward swept wings to overcome many present aerodynamic deficiencies. Until recently this concept suffered from loss of static stability due to wing tip deflection departure. The recent breakthroughs in aeroelastic tailoring at wing structure may lead to resolution of this tip departure problem and realization of substantial performance improvement. A detailed analysis is required to examine the full potential of forward swept wings for advanced fighter aircraft.

An investigation of the aerodynamic and aeroelastic implication of forward swept wings will be carried out using current analysis methods. Studies will be cast in a framework of planned mission requirements using advanced aft-swept baselines.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0023, WIND TUNNEL STUDIES OF ADVANCED CARGO AIRCRAFT CONCEPTS

G.L. Goglia, Old Dominion University, School of Engineering, Dept. of Mechanical Engineering & Mechanics, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NCC 1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, AEROTHERMODYNAMIC HEAT SHIELD ENVIRONMENTS

D. Bershader, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

2.0002, EFFECTS OF PAYLOAD HANDLING CONSIDERATIONS ON SPACE SHUTTLE TRAJECTORIES DURING PROXIMITY OPERATIONS

W.T. Fowler, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Research, *200 W. 21st, Austin, Texas* 78712

Research is being conducted into the proximity operations, or rendezvous, phase of space shuttle missions involving payload recovery. One and two impulse trajectories from stationkeeping locations within 1000 feet of the target body payload are being considered. A one impulse trajectory is defined to have a final relative velocity less than or equal to 0.2 ft./sec. This value is the maximum allowable rate (at maximum payload mass of 3200 lb.) for RMS capture. All successful rendezvous trajectories must meet rigid constraints on plume impingement, crew visibility, total fuel consumption, total coast time (time from first impulse to final approach), and safety.

SUPPORTED BY University of Texas

2.0003, NUMERICAL METHODS IN OPTIMAL CONTROL

D.G. Hull, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: Current research in this area is being directed toward optimal control using parameter optimization with numerical derivatives. One problem being investigated concerns system identification applied to the reduction of flight test data for atmospheric reentry vehicles. Another problem concerns the development of a method for computing numerical derivatives accurately.

SUPPORTED BY University of Texas

2.0004, ORBITAL MECHANICS OF LARGE SPACE STRUCTURES

B.E. Schutz, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: Various applications using large structures in space have been proposed including solar power stations and space colonies. Some of the proposals utilize orbits which are resonant with the moon, the sun, the earth's gravitational field, etc. As a consequence, large amplitude oscillations occur in some cases which could significantly influence the selection of particular orbits for large space structures. Current analysis is concentrating on 1) general characteristics of orbital motion in these resonant cases; 2) ascertaining the existence of small amplitude motions; and 3) the general characteristics of the rotational motion of a large structure.

SUPPORTED BY University of Texas

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, HYDROGEN UPON AND WITHIN MATERIALS USING NUCLEAR MAGNETIC RESONANCE

R.W. Vaughan, California Inst. of Technology, School of Engineering, Dept. of Chemistry & Chemical Engin, *1201 E. California Blvd., Pasadena, California* 91109 (DMR7721394A02)

This grant permits purchase of a super-conducting magnet to complete construction of a state-of-the-art, high-field, high-resolution nuclear magnetic resonance (NMR) spectrometer for the study of solids and solid surfaces. NMR spectroscopy of liquid solutions has become an extremely important technique in chemistry. Application of NMR to solids, however, has been limited because of solid-state interactions. The purpose of the new spectrometer system is two-fold. The first is to significantly enlarge the scope of Professor Vaughan's work in the development of high-resolution, solid-state NMR. Specifically, techniques are being developed for the study of non-integral spin systems. These include nuclei of interest for solid-state chemical research such as lithium-7, boron-11, and sodium-23. The second purpose is to extend the range and rapidity of research, carried out by workers from the California Institute of Technology and from other institutions, on surface species on oxide catalysts and dispersed metal catalysts, and inorganic hydrides, metal cluster complexes, and metallic systems.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

3.0002, CORROSION INHIBITION OF BEARING ALLOYS

J.W. Butler, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980145)

The objective of this work unit is a process for treating the high-quality bearing and transmission alloy AISi-52100 so that it will not corrode in normal usage.

The approach is to apply ion implantation techniques to produce a graded alloy near the surface, with the alloy at the surface being corrosion-resistant and with a smooth transition from this new surface alloy to the basic AISi-52100 substrate alloy. Specific alloying elements to be implanted and tested will be chromium, molybdenum, tantalum, and titanium.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air
Systems Command

3.0003, INITIATION OF CRACKS IN LCF OF TI ALLOYS

G.R. Yoder, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980076)

Determine the relationship between low-cycle fatigue crack initiation resistance and fatigue crack propagation resistance for select microstructural modifications, so that a fundamental basis for metallurgical optimization of total fatigue life can be established. Establish rational micromechanistic interpretation of results.

Systematically determine the low-cycle fatigue crack initiation resistance of Ti-6Al-4V for microstructural modifications which are already well characterized in terms of fatigue crack propagation resistance, mechanical properties and quantitative metallographic parameters. The different microstructures, as affected by changes in heat treatment and interstitial oxgen content, are to be examined for crack initiation resistance under conditions of constant stress amplitude.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air
Systems Command

3.0004, HIGH-TEMPERATURE MOLECULES AND MOLECULAR ENERGY STORAGE

W. Weltner, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Chemistry, *208 Tigert Hall, Gainesville, Florida* 32601 (DF042010; AFOSR-76-2906)

AF function - rocket propulsion, electromagnetic weaponry. Deficiency - structural and spectroscopic information on molecular species found in high-temperature systems such as wakes, plumes, nozzles, lasers and combustors is required for improved design features of Air Force systems. Objective - research includes optical and electron spin resonance (ESR) spectroscopy of molecular species and the spin-alignment of radicals at high magnetic fields and low temperatures. How work contributes - the optical and ESR spectra of high-temperature species provide information on vibrational, electronic and magnetic energy levels which is useful in plume identification and suppression and in the development of advanced lasers. Spin-aligned radicals provide a potentially important source of advanced, high-energy propellants.

Species are vaporized and trapped in solid argon matrices at 4-10 degrees K for the study of their optical and ESR spectra. Species to be examined include carbon molecules (C5, C6), silicon species (SiC, SiN, SiO2), the oxides, hydrides, fluorides and nitrides of the transition metals Mn, V, Fe, Cr, Ni and Yb, and Hf2 and HCl2. A molecular energy storage apparatus has been constructed to allow spin alignment of radicals at high magnetic fields and low temperatures and will be tested.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of
Scientific Research

3.0005, NAVY VEHICLE DESIGN AND CONSTRUCTION - RESIDUAL STRESS ANALYSIS IN METALS AND ALLOYS

J.B. Cohen, Northwestern University, Evanston Campus, Technological Inst., Dept. of Materials Science, *633 Clark St., Evanston, Illinois* 60201 (DN923045; N00014-78-M-0079)

The service life of critical naval components such as gears, bearings, and helicopter blades depends on the fatigue resistance developed by heat treatment and surface processing. This program will invesitgate the nature and effect of residual stresses on the fatigue behavior of these materials.

The plastic zone in front of a fatigue crack will be examined in Al-Cu and Al-Zn alloys using a small X-ray beam to determine the nature of the fatigue damage. This will be related to the fatigue hardening and fatigue softening observed in these alloys. Residual stress analysis will be explored to find out why the X-ray measured stress depends on the particular X-ray diffraction peaks used in the determination. Technical coverage of an important meeting will be provided in the form of written review.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of
Naval Research

3.0006, MECHANISMS OF HYDROGEN EMBRITTLEMENT IN METALS AND ALLOYS USED IN NAVAL STRUCTURES

H.K. Birnbaum, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Mining Engineering & Metallurgy, *207 Engineering Hall, Urbana, Illinois* 61801 (DN123376; N00014-75-C-1012)

This research undertakes to clarify the mechanisms by which hydrogen can embrittle metals and alloys, such as those used for naval aircraft and ship structures.

Crack initiation and propagation mechanisms in metal--hydrogen alloys are being investigated over a range of hydrogen contents, temperatures and stress conditions. Standard metallurigical techniques are being used.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of
Naval Research

3.0007, A THEORETICAL INVESTIGATION OF SPECTRAL LINE SHAPE

K.M. Sando, University of Iowa, School of Liberal Arts, Dept. of Chemistry, *Jessup Hall, Iowa City, Iowa* 52240 (CHE79-12456)

This grant supports research under the Quantum Chemistry Program to develop mathematical models for the shapes of spectral lines in gases. These models provide fundamental information about interatomic interaction energies, which is important for understanding how atoms exchange energy with one another and with electromagnetic radiation during collisions. The models can be used to interpret and predict the results of experiments which are now possible with modern laser technology.

Professor Sando will extend his theoretical investigations to include satellite bands that are observed in the resonance broadening of cesium. The concept of pairwise additivity of interatomic potentials will be incorporated in atomic line shape theory. New computational methods will be developed to fit the potential to a full line shape and to include coupling among atomic states in a computer simulation code. Several commonly used approximations in line shape theory will be tested numerically. An objective of the research is to invert line shapes to recover the interatomic potential.

This is a renewal of research currently supported by NSF grant CHE-7611968 at The University of Iowa.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Chemistry

3.0008, ELECTRONIC STRUCTURES AND CHEMICAL BONDING OF SMALL METAL AND ALLOY AGGREGATES

K.H. Johnson, Massachusetts Inst. of Technology, School of Engineering, Dept. of Metallurgy & Materials Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR7818800)

Research previously supported by DMR7415224.

Theoretical studies of the electronic structure of solids will be carried out, including the completion of work on transition-metal impurities in copper and the extension of cluster molecular-orbital calculations to transition-metal impurities in aluminum. The calculation of residual resistivities, spin densities, electric and magnetic hyperfine parameters on the basis of the cluster spin-orbitals is planned, along with the further investigation of Jahn-Teller effects and spin-orbit coupling. A reformulation of the Anderson model Hamiltonian, particularly the 'U parameter,' to account for the large bonding-antibonding interaction and much reduced exchange splitting of the impurity orbitals will be attempted, along with a parameterization of a model spin Hamiltonian on the basis of the cluster electronic structures. Possible relationships between the concept of 'cluster renormalization' and the renormalization-group method of attacking the Kondo problem will be explored, including a computational procedure analogous to that of the renormalization-group method for determining the effects of successive surrounding shells of atoms on the impurity. The cluster molecular-orbital method will also be applied to Fe impurities in palladium as a basis for explaining the occurrence of 'giant magnetic moments' in such a dilute alloy system. Extensions of the cluster method to nondilute transition-metal alloys, including impurity-impurity interaction, solid-solution alloys, and intermetallic compounds are also part of our long-range research objectives. Finally, concurrent continuing theoretical studies of metallic and bimetallic clusters of catalytic importance will be done. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

3.0009, HIGH-TEMPERATURE PROPERTIES OF EUTECTICS, DIRECTIONALLY SOLIDIFIED ALLOYS AND MONOCRYSTALS FOR POTENTIAL ARMY AIRCRAFT ENGINE

P.J. Ahearn, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0C4808)

Properly chosen eutectics, directionally solidified alloys or monocrystals may provide the optimum method for making turbine blades and vanes.

Mechanical properties of eutectics and other alloys are influenced by the solidification parameters. Currently properties are optimized by rapid cooling, directional solidification, solidification as a monocrystal, etc. These methods have limitations and thus experimets are being conducted to improve upon the techniques and also to devise new methods of solidification. Current interest is centered upon experiments involving controlled liquid flows artificially introduced at the liquid-solid interface during solidification.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel
Development & Readiness Command,
Materials & Mechanics Research Center

3.0010, RESEARCH ON CORROSION AND CORROSION-RESISTANT STRUCTURAL AND PROPULSION SYSTEMS MATERIALS

S.J. Ketcham, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN833088)

Since the overall structural integrity of naval aircraft has a critical dependence on the elimination of catastrophic failures due to corrosion and/or embrittlement, work in this unit involves research on the interactions of environment and stress on high-strength alloys and composite materials as they relate to corrosion susceptibility and propensity to environmental cracking, and on ways to measure and mitigate these factors.

Research is being pursued on the mechanisms and detection of microstructural corrosion and environmental cracking of high-strength steels and aluminum alloys by advanced state-of-the-art metallurgical and electrochemical techniques; on the corrosion response of advanced systems, e.g., sintered and composite materials; and on new laboratory accelerated corrosion tests and corrosion/embrittlement detection systems for fleet use.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air
Systems Command

3.0011, INVESTIGATION OF REINFORCED THERMOPLASTIC COMPOSITES

J.T. Hoggatt, Boeing Co., Boeingaerospace, *7555 E. Marginal Way S., Seattle, Washington* 98124 (DN890171; N00019-79-C-0203)

To evaluate fiber-reinforced thermoplastics for aircraft and missile structures.

To develop methods for impregnation and fabrication of high-temperature thermoplastic materials. Evaluate significant mechanical and physical properties of laminates. Initiate synthesis and reformulation efforts to develop improved polymer systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air
Systems Command

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality

Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, TURBULENT SHEAR FIELDS

B.Z. Jenkins, U.S. Dept. of Defense, Army, Missile Research & Development Command, Technology Lab., *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0G1107)

The objective is to analytically and experimentally characterize the FAR field rocket exhaust as a source of operational and flight interference. In particular, the evaluation of large remanent turbulence eddies in proximity to the launch structure and the ground are to be studied in view of their tendency to produce a persistent disturbed aerodynamic and uv/ir/optical propagation environment.

Rocket sled facilities will be used to better define the properties of the exhaust plume at great distances from the exit. Computer codes for predicting the effects of these flow fields on obscuration due to smoke and/or dust entrainment and on objects immersed in them will be acquired or developed.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Technology Lab.

4.0002, TO PROVIDE ENGINEERING SERVICES TO IMPLEMENT SOFTWARE, ON NAVAJO COMMUNITY COLLEGE PDP11-70 COMPUTER

S.F. Isher, Navajo Community College, Undergraduate School, *Tsaile, Arizona* 86556 (NSG 737)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

4.0003, ROLE OF MICROSTRUCTURE IN EPITAXIAL REGROWTH IN METAL-SEMICONDUCTOR INTERFACES 15999-MS

R.A. Armistead, Advanced Research & Applications Corp., *1223 E. Arques Ave., Sunnyvale, California* 94086 (DA0G8993; DAAG29-79-C-0014)

To study the mechanism of solid-phase epitaxial regrowth in metal-semiconductor systems. Relevance - the research is relevant to processing of silicon for integrated circuits which are used in a multitude of Army electronics components for communications, signal processing, computers, etc. It is also relevant to the understanding of the behavior of integrated circuits subjected to radiation environments.

The program will include (1) growth of Al/Si structures. (2) ion implantation of Al and protons in Al film; protons, Si, B, As, In and Si film; Si, B, As, In and Si film to create amorphous Si. (3) characterization of specimens using TEM/TED/SEM, AES. (4) measurement of I-V and C-V characteristics.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0004, RESEARCH ON TURBULENT MIXING

A. Roshko, California Inst. of Technology, Graduate School, Dept. of Aeronautics, *1201 E. California Blvd., Pasadena, California* 91109 (DN975341; N00014-79-C-0365)

The objective of this study is to develop a better understanding of the mechanics of turbulent structure and mixing, including large-scale entrainment processes, smaller scale molecular mixing processes, and the interaction between them. This information is needed for improved prediction of both reactive and non-reactive mixing processes within various components of turbojet and ramjet engines and to provide a basis for better control of such mixing. Ultimately it should lead to improved propulsion systems for naval weaponry applications.

A mixing region will be formed between two adjacent nonidentical liquid or gaseous streams. The dependence of the mixing process on various relevant parameters will be investigated through a combination of coupled flow visualization studies and quantitative measurements. Flow visualization will be accomplished in the liquids by means of conventional and fluorescent dye tracers and infinite rate chemical indicators, and in the gases with shadowgraph or schlieren photographs of gaseous tracers of different density than the mixing gases. Quantitative measurements will be made using laser velocimetry for the liquids and species concentration sampling probes in the gases.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0005, CALCULATIONS FOR TURBULENT FLOWS IN DUCTS

T. Cebeci, McDonnell Douglas Corp., *3855 Lakewood Blvd., Long Beach, California* 90808 (DN890141; N00019-78-C-0613)

Development of methods for the calculation of turbulent flows in ducts. Analytical study.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0006, ACQUISITION OF A SYSTEMATIC DATA BASE FOR WING-ALONE CHARACTERISTICS AT HIGH ANGLES OF ATTACK 16030-E

J.N. Nielsen, Nielsen Engineering & Research Inc., *510 Clyde Ave., Mountain View, California* 94043 (DA0G9031; DAAG29-79-C-0020)

To obtain, experimentally, systematic wing-alone data base measurements which are as free as possible of support interference effects and which extend to higher aspect ratios. Relevance - the research is directly relevant to the prediction of aerodynamics and hence performance of tactical air defense missiles.

A variety of pressure and force wing models with varied aspect ratio, taper and airfoil sections will be tested for subsonic and low supersonic speeds in the Ames 6-by-6 foot supersonic wind tunnel and for moderate to high supersonic speeds in the Langley unitary 4-by-4 foot wind tunnel.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0007, SURVEILLANCE - EFFICIENT EXCIMER DISCHARGE LASER

D.E. Rothe, Northrop Corp., Research & Technology Center, *1 Research Park, Palos Verdes Peninsula, California* 90274 (DN875654; N00014-78-C-0831)

The objective of this work unit is to contribute to the development of a satellite-mounted blue-green laser that is suitable for Navy communication and surveillance applications.

To accomplish the proposed objective, an experimental and theoretical program will be pursued to optimize power coupling into the rapidly changing load characteristics typically encountered with high-pressure self-sustained gas discharges. A novel high-pressure gas laser device that employs high-voltage transverse electrical preionization and high-impedance longitudinal electrical excitation will be designed, built, and characterized using KrF, XeCl, and N2 gas mixtures. A computer model will be developed that is capable of describing the time-dependent electrical and power coupling characteristics of both this device and a contractor-owned uv preionized transverse excited device. Model predictions will be compared with experimental results and optimum drive circuits for both laser devices and will be designed, fabricated, and tested.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0008, MILLIMETER WAVE COMMUNICATIONS TECHNOLOGY

W.H. Watson, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Electronics Engineering & Sciences Dept., *San Diego, California* 92152 (DN988682)

Develop millimeter wave components for a Q-band transmitter chain in support of satellite communication systems.

Develop components for the transmitter system to include an S- to Q-band power-up converter, a 10 watt solid-state amplifier and a 250 watt traveling wave tube (TWT) amplifier. Supporting contractual work reported under DN987685.

SUPPORTED BY U.S. Dept. of Defense, Naval Electronic Systems Command, Electronic Technology Div.

4.0009, SOLAR FLARE PREDICTION (PART OF BLOCK PROGRAM FOR EM/EO)

J.H. Richter, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Environmental Sciences Dept., *San Diego, California* 92152 (DN888505)

Determination of solar flare precursor and development of forewarning criteria for the purpose of improved naval communication by minimizing the effects of communications blackouts and disturbances caused by solar flares.

High-resolution solar radiation temperature contour maps will be analyzed by examining the temporal and spatial characteristics of active regions at 3.3mm, 8.6mm, 2.0cm, 3.2cm and 9.1cm wavelengths. By comparing active-region parameters obtained from the analysis, a description will be developed to be used in solar flare modeling and to determine solar flare precursor criteria. Correlations to solar emissions at other wavelengths will be made.

SUPPORTED BY U.S. Dept. of Defense, Naval Material
Command, Support Technology Div.

4.0010, SAW READOUT

J.P. Rahn, U.S. Dept. of Defense, Navy, Naval Weapons Center, *China Lake, California* 93555 (DN782271)

To carry out a program which will lead to the development of an infrared imaging system that is readout by means of surface acoustic waves. Such a system could operate in either the 3-5 micron or 8-14 micron bands and would have many desirable features that are nonexistent in present systems, e.g., low cost, compact, rugged, no moving parts and room temperature performance may be possible.

The electric field of a surface acoustic wave propagating on a piezoelectric material (such as lithium niobate) penetrates into an adjacent semiconductor and experiences attenuation and phase shift due to the presence of free charge carriers in the latter. This effect will be utilized to sense spatial variations in infrared intensity on either a narrow band-gap semiconductor or a pyroelectric material. Measurements will be made that will result in a definitive statement of the applicability of surface acoustic wave scanning of infrared imagery to the needs of the Navy. It is anticipated that industry involvement in this program will begin during FY78.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air
Systems Command

4.0011, LASER-PLASMA INTERACTIONS

F.F. Chen, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Electrical Sci & Engin, *405 Hilgard Ave., Los Angeles, California* 90024 (EY-76-S-03-0034 PA #236)

In inertial confinement fusion, an important problem is the coupling of driver energy to the target pellet in the region of the corona plasma that is produced on the surface of the target. The object of this program is to study the interaction of CO2 laser light and high-power microwaves with independently produced plasmas, so as to verify theoretical predictions on the various non-linear processes that can occur. Among these phenomena are parametric reflection via stimulated Brillouin and Raman scattering; nonlinear refraction and filamentation; nonclassical absorption via parametric decay, oscillating two-stream, and two-plasmon decay instabilities; resonance absorption; generation of fast ions and electrons and of spontaneous magnetic fields; and reduced heat transport. The first phenomena on this list are currently under investigation.

RESULTS: In the CO2 program, the first detection of stimulated Brillouin scattering in a thermal plasma was achieved. The apparatus has been upgraded to give higher intensity, shorter pulses, and a more reproducible plasma target. In the microwave program, the effect of finite pump bandwidth has been investigated on the parametric decay threshold, fast electron generation, density profile modification, and spontaneous magnetic fields.

SUPPORTED BY U.S. Dept. of Energy, Div. of Laser Fusion

4.0012, A GALERKIN-FINITE ELEMENT TECHNIQUE FOR SMALL-SCALE ATMOSPHERIC FLOWS AND TRANSPORT OVER GENERAL TERRAIN 15810-GS

R.L. Sani, University of Colorado, Boulder Campus, School of Engineering & Applied Science, Dept. of Aerospace Engineering Sciences, *1200 University Ave., Boulder, Colorado* 80302 (DA0G8967; DAAG29-79-G-0045)

To develop and assess a primitive, variable, Galerkin-finite element (GFE) technique which can accomodate general topography and which leads to a discretized system involving only velocity model unknowns. Relevance - many battlefield problems involve understanding of air flows in complex terrain. This is basic research which has long-range relevance to better modeling of air flows based on observations at a few sites.

The approach involves exploring theoretically and numerically the possiblities that GFE techniques are appropriate for application to small-scale flows where irregular terrain is a problem.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel
Development & Readiness Command,
Army Research Office

4.0013, REUSABILITY OF FILAMENT-WOUND LAUNCH TUBES

C.M. Minke, Hercules Inc., *910 Market St., Wilmington, Delaware* 19806 (DA0G1081; DAAK40 78 C 0101)

Find cost-effective techniques and methods of reducing to acceptable limits the ablation of the bore of fiber-reinforced composite launch tubes by the exhaust from rockets using aluminized propellant.

The task involves: A. Assessing the interior environment of the launch tube. Three diameter ranges are being considered - 2.5-6.0 inches, 6-10 inches, and 10-16 inches. B. Selecting possible composite candidates that will withstand the environments. C. Qualitatively assessing the suitability using primarily a blown flame source.

SUPPORTED BY U.S. Dept. of Defense, Missile Research &
Development Command, Ground
Equipment & Missile Structures
Directorate

4.0014, ELECTRONIC DEVICES & CIRCUITS FOR USE IN RADIATION ENVIRONMENTS

H.L. Hughes, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN020143)

The objective is to improve the reliability of transistors, integrated circuits, and other semiconductor devices required to operate in nuclear radiation environments (nuclear-weapon and space environments). Such circuits and devices are required in naval missile, satellite, and ship systems (e.g., Trident, GPS, DMSP, MEECN, MX).

The approach is to develop a complete family of radiation-hardened CMOS/SOS bulk silicon and NMOS LSI circuits. The most radiation-susceptible region of CMOS devices is the insulator-semiconductor interface. Techniques to reduce the radiation sensitivity of this interface are being pursued. Silicon dioxide films with highly controlled electrical properties are being grown and deposited on silicon device substrates. The reduction of radiation-induced surface effects in bipolar devices and circuits is also being investigated. LSI/VLSI fabrication techniques such as E-beam and X-ray lithography are being investigated in terms of hardness.

SUPPORTED BY U.S. Dept. of Defense, Defense Nuclear
Agency

4.0015, TRAINING EFFECTIVENESS EVALUATION IN FLIGHT TRAINING

J.A. Puig, U.S. Dept. of Defense, Navy, Naval Training Equipment Center, Human Factors Lab., *Orlando, Florida* 32813 (DN994029)

The objective of this task is to develop a training effectiveness evaluation technology that can be applied to current and future training programs. This effort will prove useful in establishing guidelines for evaluating training programs and their training devices.

This effort will involve the following tasks: (a) develop a training effectiveness evaluation (TEE) technology with the intent of refining techniques to provide more efficient and sensitive instruments for evaluation, (b) develop guidelines and publish a 'handbook' or guide to training evaluation, (c) apply and validate the methods described in the guide, and (d) develop a TEE specification and data item descriptions (DIDs).

SUPPORTED BY U.S. Dept. of Defense, Naval Training
Equipment Center, Human Factors Lab.

4.0016, DYNAMICS OF COMPOSITE MATERIALS AND ELASTIC STRUCTURAL ELEMENTS WITH VARIABLE DIMENSIONS 15872-E

S. Nemat Nasser, Northwestern University, Evanston Campus, Technological Inst., Dept. of Civil Engineering, *633 Clark St., Evanston, Illinois* 60201 (DA0F9277; DAAG29-78-G-0149)

The development and exploitation of a new methodology for an effective and accurate response of elastic composites and the vibration of elastic structural components which have relatively large variations in their stiffness, mass distribution and/or dimensions. Relevance - the dynamic response of optimized lighter weight missile and aircraft structures constructed of composite materials requires critical analysis. The use of composites with meaningful dynamic analysis will result in improved helicopter components.

Appropriate mixed variational principles will be used in connection with either a Ritz-type approximation (for composites and structures with regular geometries) or with a finite element approach (for irregular geometries).

SUPPORTED BY U.S. Dept. of Defense, Army Materiel
Development & Readiness Command,
Army Research Office

4.0017, DYNAMIC RESPONSE OF ROTOR/BEARING SYSTEMS

C. Cusano, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Mechanical & Industrial Engineering, *207 Engineering Hall, Urbana, Illinois* 61801

The purpose of this analytical investigation is to study the dynamics of rotors supported in fluid-film bearings. The areas which are being investigated include: (a) The transmissibility and stability of gas-lubricated, externally pressurized porous journal bearings supporting a rigid rotor. (b) The transmissibility characteristics of flexibly-mounted rolling-element bearings and fluid-film bearings in porous bearing squeeze-film dampers. Results obtained from relatively simple rotor-bearing models have demonstrated that porous bearings, under certain operating conditions, can be more effective dampers than solid bearings operating under the same conditions.

SUPPORTED BY University of Illinois

4.0018, A GRAPHICAL INTERPRETATION OF VARIABLES IN LAMBERT'S PROBLEM

J.E. Prussing, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aeronautical & Astronautical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801

In orbital mechanics Lambert's problem is the classical boundary value problem of determining the two-body orbit which connects two given position vectors in a specified flight time. It is used in modern-day spacecraft targeting problems. In the classical formulation for the time-of-flight equation, due to Lagrange, two variables appear which are functions of the geometry of the terminal radii and the energy of the transfer orbit. A simple geometrical interpretation of these variables as angles has been obtained. Applications of this interpretation to the solutions of the boundary value problem are being investigated.

SUPPORTED BY University of Illinois

4.0019, A QUANTITATIVE APPLICATIONS-ORIENTED EVALUATION OF THEMATIC MAPPER DESIGN SPECIFICATIONS

P.H. Swain, Purdue University, Graduate School, *Executive Bldg., West Lafayette, Indiana* 47907 (NSG 5414)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

4.0020, NON-SATELLITE COMMUNICATIONS RELAYS

A. Durling, Booz Allen & Hamilton Inc., Applied Research Division, *4330 East West Hwy., Bethesda, Maryland* 20014 (DN981088; N62269-78-C-0437)

The technical objective of this task is to examine specific relay modes as part of the feasibility assessmet of expendable relays. This work supports work unit ZE 103, Agency Accession DN 681003.

The approach is to utilize the data base and analysis provided under NADC contract N62269 74 C 0231 and apply the concepts generated under the contract to the assessment of the expendable relays.

SUPPORTED BY U.S. Dept. of Defense, Naval Air
Development Center, Communication
Navigation Tech Directorate

4.0021, INVESTIGATION OF AUTOMATIC PICTURE TRANSMISSION RELATIVE TO SPACE SCIENCES

C.H. Kirksey, Bowie State College, Graduate School, *Bowie, Maryland* 20715 (NSG 5416)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

4.0022, NAVY VEHICLE DESIGN AND CONSTRUCTION - DESIGN TECHNIQUES FOR MULTIVARIABLE DIGITAL CONTROL SYSTEMS WITH MULTIPLE SAMPLE RATES

S.W. Gully, Analytic Sciences Corp., *6 Jacob Way, Reading, Massachusetts* 01867 (DN975440; N00014-79-C-0431)

During the design of a digital flight control system, it can be advantageous to have different feedback loops sampled at separate rates in order to save on computer requirements. For example, the response characteristics of an inner stability loop and an outer guidance loop are usually an order of magnitude apart and, therefore, the sample rates of each loop can also differ by the same amount. No modern control theoretical technique exists for designing multivariable digital control systems with multiple sample rates. The purpose of this project is to develop practical synthesis and analysis methods for multirate digital control systems.

The optimal multirate control problem will be formulated by starting with the optimal multirate estimation procedure which has been developed by the contractor. The general optimal multirate estimation and control problem will then be solved. The algorithms which are developed will be exercised on a realistic aircraft with multirate sensors and actuators. Optimal multirate control law and state estimation will be constructed and compared with single rate designs to illustrate the advantages and differences in complexity between them. An algorithm which will automatically guarantee a stabilizing initial starting property will be developed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of
Naval Research

4.0023, ENERGY CONVERSION COMPRESSOR BLADE FLUTTER MEASUREMENT USING RETROREFLECTORS

J.L. Kerrebrock, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DN875763; N00014-78-C-0536)

The objective of this project is to assess the viability of compressor blade flutter measurements utilizing a retroreflector technique developed at Aerodyne Research, Inc. The effort is experimental in nature and is aimed at direct measurements of aerodynamic damping coefficients in terms of interblade phase angle, tip Mach number, and pressure ratio. This research will contribute to an increased understanding of the effects on performance of one of the limiting factors in the design of fan and compressor blades (blade flutter), and hopefully result in increased performance of gas turbine engines needed for naval aircraft propulsion, but useful as well to marine power plants and fixed installations.

An instrument designed, built, and calibrated by Aerodyne Research, Inc., has been procured by the M.I.T. gas turbine laboratory. It will be utilized in an M.I.T. blowdown compressor to conduct blade flutter measurements for correlation with conventional on-going flutter research. Capability of the sensor will be extended to include two channels and to detection of the direction as well as the amplitude of the motion.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of
Naval Research

4,0024, GENERATION OF FREE RADICALS AND IONS FOR SPACECRAFT PROPULSION

J. Asmussen, Michigan State University, School of Engineering, Dept. of Electrical Engineering, *Engineering Bldg., East Lansing, Michigan* 48824 (NSG 3299)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lewis Research Center

4,0025, CURVATURE EFFECTS ON EFFECTIVENESS AND HEAT TRANSFER IN THREE-DIMENSIONAL FILM COOLINGS 16595-E

E.R. Eckert, University of Minnesota, St. Paul Campus, Graduate School, *St. Paul, Minnesota* 55101 (DA0G9098; DAAG29-79-C-0117)

To conduct an experimental and analytical fundamental study to determine the influence of curvature for the design of film cooling arrangement of turbine blades. The curvature of the turbine blades will affect the heat transfer coefficient and will be used to predict the blade temperatures and, consequently, the ensuing blade thermal stresses. Relevance - this work is applicable to Army helicopter engines where the current trend is to higher temperature, highly cooled gas turbines.

The heat transfer of flow around a circular cylinder, with coolant injection through a row of holes, will be measured in a low-speed wind tunnel. The pressure variation along the cylinder surface, as well as the boundary layer development without and with film cooling, will be obtained. The mass transfer analogy will be used to determine the film cooling effectiveness. Foreign gas will be ejected through the holes and the condensation of this gas along the cylinder surface downstream of the holes will be measured using a gas chromatograph. A second cylinder covered by a thin layer of naphthalene will likewise be tested.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel
Development & Readiness Command,
Army Research Office

4,0026, INCOMPRESSIBLE AXISYMMETRIC WAKES

F.R. Hama, Princeton University, School of Engineering & Applied Sciences, Dept. of Mechanical & Aerospace Engineering, *Box 430, Princeton, New Jersey* 08540 (ENG78-24177)

This is a continuation of research previously supported under NSF Grant ENG 77-28247 dealing with the instability, vortex formation or shedding, and transition behind an axisymmetric body. The central focus is on the mechanisms within nonlinear stability theory leading to transition to turbulence in axisymmetric flows. During earlier grant periods an elaborate suspension system was constructed to accommodate the necessary critical alignment of the test model. A misalignment of one minute of angle could result in asymmetry of the mean velocity distribution which in turn promotes flow instability. Experiments conducted show features not found in other experiments such as appearance of higher harmonics in the spectra and appears to be associated with a two-dimensional-like travelling wave instead of the helical mode assumed in the current theory. This grant will provide support to complete the stability experiments.

SUPPORTED BY U.S. National Science Foundation, Div. of
Engineering

4,0027, HOLOGRAPHIC FABRICATION OF GRATINGS IN METAL SUBSTRATES

J.M. Ballantyne, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (NSG 1651)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

4,0028, DAMAGE REPAIR PROCEDURE

F. Drum, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN890156; N00019-79-C-0106)

To obtain a repair methodology that is cost-effective, compatible with the material requirements of the full-size hardware and permits the rapid restoration of the damaged stabilizers to original levels of structural integrity and environmental durability.

The repair approach will be the application of an adhesive-bonded boron/epoxy patch co-cured in an autoclave. The repair site will be stepped to accommodate the flush portion of the patch. The external doubler portion of the repair will be covered with a ply of fiberglass/epoxy.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air
Systems Command

4,0029, RAYS AND MODES ON CONCAVE SURFACES 15972-EL

L.B. Felsen, Polytechnic Inst. of New York, Brooklyn Campus, Graduate School, Dept. of Electrical Engineering & Electrophysics, *333 Jay St., Brooklyn, New York* 11201 (DA0G8978; DAAG29-79-C-0005)

To provide fundamental understanding of electromagnetic wave propagation on and scatter by concave surfaces and surfaces with variable curvature including effects on polarization. Relevance -results of this study will be directly relevant to ground wave propagation over uneven terrain, scatter from concave surfaces such as jet engine intake cavities, large reflector antennas and dome phase array antennas.

To proceed by studying selected cononical problems which can be solved exactly and thus provide rigorously based asymptotic results. The solutions will be cast in terms of a mixture of ray-optical and whispering gallery modes chosen in correct proportion to obtain accurate results.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel
Development & Readiness Command,
Army Research Office

4,0030, NAVIER-STOKES NUMERICAL STUDIES OF THE SUPERSONIC LAMINAR FLOW ABOUT CONES AT ANGLES OF ATTACK

Unknown, Polytechnic Inst. of New York, Long Island Center, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *Farmingdale, New York* 11735 (DN875484; N00014-78-C-0597)

The development of accurate methods to compute the flow fields about bodies for complex flow situations is essential for the aerodynamic design and optimization of aircraft and missiles. In the proposed investigation, the laminar flow over a yawed cone will be studied within the the framework of the Navier-Stokes equations. Particular attention will be devoted to the formation of vortices near the leeward symmetry plane; the formation of cross-flow imbedded shocks; and the strong viscous-inviscid interactions for both the axial and the secondary flows.

A new solution procedure, for the Navier-Stokes equations in primitive variables, which utilizes the fact that the flow has a dominant (axially) direction will be used. The difference equations will employ a filtering technique, which in model problems has drastically reduced oscillations associated with captured shocks. The filtering procedure is equivalent to a weighted-average of conservation and non-conservation differencing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of
Naval Research

4.0031, RESEARCH ON MICROWAVE JUNCTION-GATE FIELD EFFECT TRANSISTORS 13586-EL

S.K. Ghandhi, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Electrical Engin, *110 8th St., Troy, New York* 12181 (DA0E9120; DAAG29 76 G0172)

To investigate and improve junction field effect transistors in III-V compounds. Relevance - electronic III-V compound devices permit operation into tens of gigahertz; junction gate field effect transistors are expected to be more reliable than presently used Schottky gate field effect transistors. Vital relevance to communication/navigation satellites, tactical communication links, missile guidance, ew equipment.

To study basic problems associated with the growth and characterization of the channel layer, and with obtaining an improved understanding of diffusion and masking problems associated with the junction gate.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel
Development & Readiness Command,
Army Research Office

4.0032, IMPROVED CONTAMINATION CONTROL OF CIRCULATING ENGINE LUBRICATING OIL

J.A. Tichy, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Mechanical Engineering, *110 8th St., Troy, New York* 12181 (DN975183; N00014-79-C-0100)

The objective is to upgrade the technology for separation of contaminants from circulating lubricating oil. Recent studies of maintenance procedures in naval diesel-powered ships and aircraft engines have clearly indicated that the contamination of circulating lubricating oil is a major source of increased wear and friction, premature failure of machine elements, and high maintenance costs.

The approach will be to conduct an investigation study of new available technology which can be used to solve current ship and aircraft circulating oil problems. The study will be performed in four phases: (a) determine particulate content of used oils, correlate with measured rheological behavior. (b) develop a lubrication filtration theory. (c) conduct controlled filtration experiments to test the filtration theory. (d) perform centrifugal filtration studies and wear tests.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of
Naval Research

4.0033, IMPROVEMENT OF NONLINEAR TRANSIENT ANALYSIS EFFICIENCY

R.J. Melosh, Duke University, School of Engineering, Dept. of Civil Engineering, *Durham, North Carolina* 27706 (NSG 1647)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

4.0034, THE APPLICATION OF OPTICAL COMPUTING TECHNIQUES TO JET ENGINE CONTROLS

S.A. Collins, Ohio State University, Columbus Campus, School of Engineering, Dept. of Electrical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (NSG 3302)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lewis Research Center

4.0035, AN INVESTIGATION OF AIR SOLUBILITY IN JET FUEL AT HIGH PRESSURE

G.M. Faeth, Pennsylvania State University, University Park Campus, School of Engineering, Dept. of Mechanical Engineering, *101 Hammond Bldg., University Park, Pennsylvania* 16802 (NSG 3306)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lewis Research Center

4.0036, PICOSECOND OPTICS

M.F. Becker, University of Texas, Austin Campus, School of Engineering, Dept. of Electrical Engineering, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: This research program is aimed at measuring fast optical phenomena on a previously unavailable time scale. We have constructed an optical delay line apparatus which can resolve fast phenomena on the 10 picosecond to 10 nanosecond time scale using mode-locked laser pulses. As a candidate for our first experiments, we have chosen the semiconducting-metallic phase transition in vanadium dioxide (VO2) at 68 degrees C. As this material is of interest as a potential optical data storage medium, the writing time and energy requirements as well as the mechanisms of the transition are of interest. Measurements of the dynamic behavior of this transition have been made by initiating the transition with a short, energetic light pulse and probing its state at some later time with a portion of the same pulse which has been optically delayed. As the delay time is changed and the transition reexcited, its response can be traced for all times of interest. Preliminary experiments show exceedingly fast (less than 10 psec.) optical excitation of a nonequilibrium state followed by an exceptionally long decay period. From this time-resolved reflection and transmission data, we can attempt to understand the dynamic behavior of the phase transition. The project is in its fourth year and expected to continue fairly indefinitely.

SUPPORTED BY University of Texas

4.0037, UNIVERSAL WIDE-BAND RECORDER

J. Rayburn, Isomet Corp., *5263 Port Royal Rd., Springfield, Virginia* 22151 (DN581147; N62269-75-C-0404)

To develop a universal wide-band recorder for airborne electro-optical sensor imagery with new real-time playback capability. This work supports work unit ZT701, Accession No. DN 781263.

The wide-band recorder developed under contract and tested at NavAirDevCen will be used as test apparatus in a study contract (CPFF) to obtain performance data on dry process films relating to image and playback quality of this recorder.

SUPPORTED BY U.S. Dept. of Defense, Naval Air
Development Center, Sensors & Avionics
Tech Directorate

4.0038, DYNAMIC IDENTIFICATION FOR CONTROL OF LARGE SPACE STRUCTURES

S.R. Ibrahim, Old Dominion University, School of Engineering, Dept. of Mechanical Engineering & Mechanics, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NSG 1649)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

4.0039, AIRBORNE ANTENNA PATTERN CALCULATIONS

R.R. Mielke, Old Dominion University, School of Engineering, Dept. of Electrical Engineering, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NSG 1655)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

4.0040, NUMERICAL SOLUTIONS OF THE TIME-DEPENDENT COMPRESSIBLE NAVIER-STOKES EQUATIONS

S. Abarbanel, Tel Aviv University, *155 Herzl St., Tel Aviv, Israel* (DF052850; AFOSR-78-3651)

AF function - aerospace vehicles. Opportunity - the design of future Air Force weapons systems will require fast and accurate solutions to complex compressible flow problems in such areas as aircraft-external weapons carriage effects, reentry flow dynamics, and flight at high angle of attack. Theoretical methods now available for analyzing such flow fields are either inadequate or excessively costly for engineering applications. Objective - to develop a variety of numerical-mathematical tools for solving the partial differential systems governing compressible (inviscid and viscous) flow and to apply them to problems of interest in aerodynamics. How work contributes - the research effort will develop numerical methods suitable for analysis of inviscid and viscous compressible flow fields, including the presence of shock waves. Effort will be directed toward increasing the accuracy, reducing computational time, and increasing the generality of application of the methods developed relative to those currently available.

A finite difference method developed previously for solving inviscid, compressible flow problems will be extended to calculate the viscous flow field for slender, blunted bodies at angle of attack. Also, a study of the stability of initial boundary value problems for the case of dissipative finite difference schemes suitable for application to aerodynamics problems and a study of the effect of boundary treatment on the stability of the overall scheme will be made. In addition, spectral methods based on Chebyshev polynomials will be used to investigate the problem of the interaction of a shock wave with a boundary layer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, GLACIOLOGY STUDIES

L.R. Mayo, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *218 E St., Anchorage, Alaska* 99501 (AK 66-049)

1. Determine the relationship between climate and snow and ice storage, runoff and ice motion in glacierized basins in Alaska. 2. Answer specific questions concerning glacier activity, potentials and hazards as construction projects and populations encounter glacier-affected streams, lakes and basin areas.

Collect long term, high quality climatic, snow balance, ice balance, ice motion and streamflow measurements and analyze these data to detect significant changes as they occur. Advise of specific hazards and benefits due to the presence of glacier activities as they arise. Maintain an up-to-date aerial photographic library from which interpretations can be made.

Key instrumentation at two glacier basins studied during the International Hydrological Decade, 1965-1974, will be maintained. These two Index Glacier Basins serve as the bases for analysis of snow cover and glacier activity monitored by aerial photographic reconnaissance throughout Alaska. Field trips to basins with specific questions are used to further refine the reconnaissance interpretation. Collect data on the regime of a glacier-dammed lake to analyze its complete cycle.

Fully integrated methods for field surveying of glacier dynamics and field/office calculating of all major results completed. These new techniques allow field verification that all items of glacier dynamics are measured adequately. Ice radar capability achieved. Dynamic response of even large glaciers to climatic changes is much more rapid than previously suspected.

Fully develop and field test a method for obtaining annual maximum and minimum balance in glaciers of any size with only one field trip a year of only a few days. This will allow development of program to monitor climatic variations of very large glaciers.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0002, DEVELOPMENT OF MARTIAN TERRACED-EJECTA DEPOSITS

M. Sheridan, Arizona State University, School of Liberal Arts, Dept. of Geology, *Tempe, Arizona* 85281 (NSG 7642)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0003, VOYAGER

L.A. Soderblom, U.S. Dept. of the Interior, Geological Survey, Astrogeologic Studies Branch, *601 E. Cedar Ave., Flagstaff, Arizona* 86001 (9580-01031)

On March 5, 1979, the Voyager 1 spacecraft will fly past Jupiter and its array of satellites, making close approaches to three of the satellites. Io, Ganymede, and Callisto will be imaged over a wide range of phase angles in both color and black and white at resolutions between one and three kilometers. Additionally, the satellites Europa and Amalphea will be imaged at FAR encounter at a resolution of about ten kilometers. The Galilean satellites are large planetary bodies, two of them are larger than our Moon and two of them are larger than the planet Mercury. The imaging data will be used for visual interpretation of the surface histories as well as to prepare color or spectral albedo maps to characterize the distribution materials on their surfaces. On July 9, 1979, Voyager 2 will make a similar pass through the Jovian system, again passing close to three of the satellites. The hemispheres of Callisto and Ganymede, which were not imaged on Voyager 1, will be imaged on Voyager 2, providing coverage of approximately 80% of those bodies at resolutions between 1 and 3 kilometers. Additionally, Europa, slightly larger than our Moon, will be imaged at a resolution of about 5 kilometers. The Jovian system is exciting from the point of view of planetary research because the satellites which revolve about Jupiter in regular circular orbits mimick the planets around the sun. The satellites exhibit regular trends such as decreasing density and increasing mass in volume with increasing distance from Jupiter. Because they have suffered identical bombardment histories, it should be possible to compare the evolutionary histories of a collection of bodies, which range from rocky satellites to large ice balls.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0004, PIONEER VENUS RADAR

H. Masursky, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-01535)

The Pioneer Venus orbiter spacecraft was launched successfully in May and will be inserted into Venus orbit December 4, 1978. Low resolution radar images and altimetry data will be acquired of the entire planet between 75 degrees N and 50 degrees S latitudes along subspacecraft tracks spaced 150 km apart at the equator. During the extended mission the ground tracks obtain coverage at a spacing of 75km at the equator. The coarse radar images and altimetry traces combined with high and low resolution Earth-based telescopic images will allow the construction of mosaics and topographic maps. These maps, combined with gravity and magnetic data obtained by the orbiting spacecraft, will increase our knowledge of the surface expression of geologic features which will provide clues to possible volcanic, tectonic and eolian processes that have operated on the planet, and eventually to a deeper understanding of Earth, the twin planet, as well as Venus.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0005, EOLIAN PROCESSES

J.F. McCauley, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02353)

STATES TO WHICH PROJECT PERTAINS: Arizona, New Mexico.

Plans include wind tunnel experiments, field observations and electron microscopy studies to determine the response of rocks of various lithologies to wind erosion, and to define the relative role of deflation as opposed to abrasion in the evolution of planetary surfaces. Systematic measurements of wind and other climatic data in various types of desert regions will be obtained in connection with another project, by emplacement of remote sensing platforms that transmit to the GOES-1 satellite, for relay to the USGS Computer Center at Flagstaff. Geologic field studies will be conducted to provide ground data on topography, vegetation, surface sediments and rock types in each area. Analysis of the data is expected to result in mathematical models of eolian processes for application to the interpretation of data from planetary missions such as Viking and Voyager.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0006, NAVY ENVIRONMENT - FOG ANALYSIS

H. Loos, Laguna Research Lab., *21421 Stans Ln., Laguna Beach, California* 92651 (DN675223; N00014-76-C-0436)

The objective of this research is to analyse and select from the electrical mechanisms operative in the coalescence of fog drops that one which is theoretically optimum as the basis for field trials of fog modification experiments. Better environmental support of naval operations constitutes the relevance of this research.

Details of the analysis will include size of charged drops in relation to fall speed and dwell time in the fog, extent of charge, relative numbers of seed drops in relation to fog density, means of production of charged drops, avoidance of corona and discharge limits for amount of charge placed in cloud, etc.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of
Naval Research

5.0007, CLOUD COVER MEASUREMENT SYSTEM

T.W. Metcalf, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Surface & Aerospace Surveillance Dept., *San Diego, California* 92152 (DN987533)

(1) To determine the relative opacity of clouds in the visible and ir spectrum. (2) To determine the percentage of time if a difference in opacity in the visible and ir spectrum exists. This information is essential in order to select an optimum EO sensor to be used on an earth surveillance satellite.

The relative opacity of clouds will be determined by comparing the energy in the visible and ir spectra radiated from the sun through the clouds. The visible radiation from the sun will be detected by a TV camera and the ir radiation by a pyroelectric Vidicon camera. The sensors will be mounted on an equatorial clock-driven mount that tracks the sun as it moves across the sky. The output of the two sensors will be monitored and analyzed by a video processor unit designed around a microcomputer. If either of the two video signals meet a predetermined criteria, the microcomputer will turn a video recorder on. The images from both sensors will be recorded for a more detailed analysis.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval
Material Command

5.0008, LABORATORY EXPERIMENTS ON THE ELECTRON ACCELERATION UNDER CONDITIONS SIMILAR TO THE AURORAL MAGNETOSPHERE

H. Boehmer, University of California, Irvine Campus, School of Physical Sciences, Dept. of Physics, *Irvine, California* 92664 (ATM79-15159)

This grant will support a laboratory experiment that should shed light on the phenomena leading to electron acceleration in the polar magnetosphere above auroral arcs. The experimental conditions will be chosen to simulate the plasma state found by the S3-3 satellite to exist in the magnetosphere: a fully ionized, magnetized and collisionless plasma with a magnetic field-aligned electron drift in a current channel whose radial extent is of the order of the hot ion Larmor radius. In this plasma, which contains strong electrostatic ion cyclotron wave turbulence, phenomena have been observed that are interpreted as the generation of suprathermal electrons. By measuring the temporally and spatially resolved electron energy distribution and plasma potential, the mechanism of the electron acceleration will be investigated and compared with various models like anomalous resistivity, trapping and electrostatic shocks or double layers.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0009, SEARCH AT SOUTH POLE FOR THE PENDULUM MODE OF THE EARTH'S INNER CORE

L.S. Knopoff, University of California, Los Angeles Campus, Inst. of Geophysics & Planetary Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DPP77-27903 A01)

The University of California at Los Angeles will continue to observe changes in the gravity at the South Pole in order to derive earth tides and earth's free vibrations. This research has been underway since 1967, most recently under grants DPP76-17234 and DPP77-27903, using two Lecoste-Romberg earth-tide gravimeters to measure vertical gravitational changes. The project will make modifications to the instruments and use a newly developed pendulum gravimeter in order to improve the sensitivity of the observations by a factor of approximately 100. The increased sensitivity will be used to search for the earth's inner-core pendulum mode. The data from the South Pole are unique because of the geographical relationship to the solar and lunar gravitational forces and because of the extreme stability and seismic quietness of the polar ice cap. The project is yielding significant data and conclusions on the inner structure and composition of the earth. During the winter of 1980, two relatively automatic, matched gravimeters will be operated by UCLA at South Pole.

One UCLA scientist is at South Pole during 1979. Another UCLA scientist will be at the South Pole during 1980. An additional UCLA scientist will be at the South Pole during the 1979-80 summer to assist in the installation and adjustment of the equipment. One additional UCLA scientist will be in training under this grant at UCLA during 1980 for possible duty at the South Pole during 1981.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Polar Programs

5.0010, SEASAT PROGRAM - AN OCEAN MESOSCALE EDDY INVESTIGATION UTILIZING SEASAT-A SMMR DATA

R.L. Bernstein, University of California, San Diego Campus, Scripps Institution of Oceanography, *P.O. Box 1529, La Jolla, California* 92038 (K7-972; MO-A01-78-00-4329)

OBJECTIVE: To create from SMMR data, oceanographically useful sea surface temperature maps with an effective grid resolution between 50 and 100 km spatially, and five days temporally. These maps will be used to study the development of strong mesoscale (200 - 600 km) meanders and eddies in the Kuroshio - Oyashio extension region (30 degrees - 45 degrees N, 140 degrees - 170 degrees W), which have detectable sea surface temperature expressions in all seasons except summer.

APPROACH: Sea surface temperature data obtained by the SEASAT-A SMMR will be assembled for the western North Pacific, and mapped in five-day blocks. The maps will be examined for internal consistency and compared with conventional XBT data obtained by ships-of-opportunity, to establish a confidence level.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic
& Atmospheric Admin., National
Environmental Satellite Service

5.0011, NAVY ENVIRONMENT - MERGING SATELLITE AND CONVENTIONAL OCEANOGRAPHIC DATA

R.L. Bernstein, University of California, San Diego Campus, Scripps Institution of Oceanography, *P.O. Box 1529, La Jolla, California* 92038 (DN975254; N00014-75-C-0152)

A series of academic and tactical studies are to take place in the Pacific Ocean in waters contiguous to the west coast of the United States. A number of these investigations will be directly or indirectly in support of Pacific Fleet activities. Those activities, particularly ASW operations, need current and forecast knowledge of surface and subsurface thermal conditions, ocean waves, surface winds, and other ocean features over broad ocean areas of their operations. These mesoscale areas can be scanned in real-time with subsequent detailed interpretation of DMSP and NOAA satellite imagery. Near simultaneous measurements of physical oceanographic parameters are essential in the validation of ground-truth interpretations of the imagery.

Remotely sensed sea surface data from satellites and aircraft will be analyzed in conjunction with in-situ ocean thermal information. These field experiments will support the basis of design criteria for satellite input to oceanographic research and subsequent fleet ocean forecasts.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of
Naval Research

5.0012, TROPOSPHERIC MEASUREMENTS OF PARTICULATES AND TRACE GASES

B.J. Huebert, Colorado College, Graduate School, *Colorado Springs, Colorado* 80903 (ATM79-06146)

Project GAMETAG (Global Atmospheric Measurement Experiments on Tropospheric Aerosols and Gases) provided significant, new data on tropospheric HNO3 and HCl vapors and particulate NO3-, Cl-, SO4--, and NH3 ion. Although important information has been obtained about global budgets for trace species, gas/particle interactions, and the photochemistry of the troposphere, large gaps remain in our knowledge. This grant funds the development and demonstration of high volume sampling techniques for use in very clean areas of the troposphere which will (1) provide size versus chemical composition information on aerosols, (2) make more specific collections of HCl and HNO3, in the presence of other acidic chlorides and nitrates, (3) collect NH3 vapor, (4) permit several metal analyses to be performed on particulates from remote areas, and (5) allow a measurement of the total aerosol acidity. These techniques will facilitate the identification of sources of trace atmospheric species and the study of reaction mechanisms not possible with present instrumentation. The techniques will be demonstrated as an auxiliary experiment on aircraft already scheduled to be deployed during the MONEX project during the summer of 1979.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0013, RADIATIVE EFFECT OF FINITE CLOUDS IN FIELDS OF CLOUDS

T.B. McKee, Colorado State University, School of Engineering, Dept. of Atmospheric Sciences, *Fort Collins, Colorado* 80523 (ATD78-27556)

The objective of this research program is to provide an increased understanding of the interaction of solar radiation in fields of clouds. Cloud geometry has been shown to have a pronounced effect on the radiances and irradiances of individual clouds. However, clouds occur in such a wide array of microphysical properties, geometric shapes, and time scales that the effect of geometry (or in broader terms, horizontal inhomogeneities) upon the energy exchange in terms of reflection (albedo), absorption, and transmission is not obvious. Theoretical treatment of radiative transfer in clouds has been extensive for semi-infinite plane parallel clouds. This research treats clouds as finite bodies. The theoretical work on finite clouds has shown that they can be very different from a piece of semi-infinite cloud and can also be very similar depending on the physical properties, solar-viewer geometry, and optical thickness. The effects of the finiteness or geometric shape upon cloud fields in the earth's atmosphere have not been investigated in detail. This project will compare finite cloud model computations with observed atmospheric data.

This research used cloud physics and radiation data collected during the 1974 field phase of the Global Atmospheric Research Program (GARP) Atlantic Tropical Experiment (GATE) objective of improving understanding of the interactions between radiation and tropical circulations.

This grant is a natural continuation of a previous GATE grant to Professor McKee.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0014, GLOBAL MAGNETISM - GM

J.C. Cain, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9780-01754)

Definitive computation of geomagnetic field. This will include analysis of Russian and U.S. Satellite magnetic data, incorporation of surface magnetic survey data and definition of transient variations due to external causes. Numerical analysis is to be done on both a global scale and local functions to define the surface field to a scale down to 2 km.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0015, GEOLOGIC APPLICATIONS OF THERMAL-INERTIA MAPPING FROM SATELLITE-HCMM

T.W. Offield, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046 MS939, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9790-02189)

To evaluate the effects of scale and resolution changes from both HCMM satellite and aircraft data, to assess the need for topographic correlation at different scales and resolutions, and to develop an automatic topographic correction technique. Also to compare thermal-inertia data from aircraft and HCMM satellite with maps of geology, soil type, soil moisture, land use, energy resources, and vegetation to correlate thermal inertia with the target geologic materials.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0016, PICEANCE BASIN SPRING HYDRAULICS RESEARCH

G.J. Saulnier, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Bldg. 53 Denver Federal Ctr., Mail Stop 415 Box 25046, Lakewood, Colorado* 80225 (CO 75-060)

Aquifer dewatering resulting from oil-shale mining will reduce groundwater discharge to streams and springs. Many springs in the Piceance Basin are used as water supplies for livestock and domestic use. The source of these springs and the potential effects of aquifer dewatering on these springs need to be determined before actual mine dewatering begins.

Locate and determine the source of major springs in the Piceance Basin, determine their flow characteristics, and predict the effects of dewatering resulting from oil-shale mining on spring flow. Collect, compile, and maintain records of spring discharge and water quality so that changes resulting from development can be determined.

Infrared color aerial photography and thermal imagery will be used to inventory springs. Samples will be collected from springs for water quality analysis. The concentrations of fluoride and chloride and water temperature will provide information to help determine if the source of spring flow is from the Uinta or Green River formation. This information is essential to improve the conceptual model of the hydrologic system. Discharge records will be collected from flumes installed at about 70 springs to provide pre-development data on springflow.

Infrared color aerial photography and thermal imagery were used to identify springs in the Piceance Basin. Flumes have been installed and discharge records are being collected at 70 springs by grant to the Colorado Department of Natural Resources, Division of Water Resources. Water-quality samples collected by the grantee from 48 springs were analyzed by the U.S. Geological Survey. Spring schedules and geologic data were compiled for 70 springs.

Analyze the discharge, water chemistry, and geologic data to determine the geologic source of selected springs. Prepare a report on the data collected and plan for continued collection of discharge and water-quality data which will provide a basis for evaluating the effects of proposed oil-shale development on springs.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Water Resources Div.

5.0017, ASSESSMENT OF HIGHWAY ENVIRONMENTAL IMPACT IN CONNECTICUT USING REMOTE SENSING PROCEDURES

W.C. Kennard, University of Connecticut, Storrs Campus, School of Engineering, Dept. of Civil Engineering, *Box U-37, Storrs, Connecticut* 06268 (192595 (HRB NO.))

Objectives are to: 1) evaluate the potential impacts on freshwater inland wetlands caused by proposed CT 275 in the Mansfield-Coventry area, using remote sensing techniques and field studies, previously tested, evaluated, and refined; 2) contrast the results of biological field studies conducted along proposed CT 195 in the winter with those conducted in the summer to evaluate relative accuracy and efficiency; 3) identify and outline those surface phenomena detectable by remote sensing techniques that might play a role in an environmental impact prediction strategy; and 4) conduct a cost-effectiveness analysis contrasting the use of color infrared and panchromatic black-and-white aerial photographs in highway corridor planning. Recent low-level CIR aerial photographs were interpreted for inland wetland delineation and classification in the corridor study area. These photographs are currently being analyzed to determine land use/cover type in the study area. Repeated wetland field studies have been conducted and these data are being analyzed statistically. Cost data for the alternate modes of aerial imagery are being collected. At the same time, measures of effectiveness are being defined and quantified.

SUPPORTED BY Connecticut State Government

5.0018, NUMERICAL STUDY OF BAROCLINIC INSTABILITY

J.E. Geisler, University of Miami, Rosenstiel School of Marine & Atmospheric Sciences, *4600 Rickenbacker Cswy., Miami, Florida* 33149 (NAS 8-33558)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
George C. Marshall Space Flight Center

5.0019, NITROGEN FIXATION AS AN ADJUNCT TO WASTEWATER PURIFICATION SYSTEMS USING WATER HYACINTHS

A.C. Rogerson, Fort Valley State College, Graduate School, *Fort Valley, Georgia* 31030 (NSG 735)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
National Space Technology Lab.

5.0020, ATMOSPHERIC POLLUTION SCAVENGING

R.G. Semonin, State Water Survey, *Box 232, Urbana, Illinois* 61801 (6440; EY-76-S-02-1199)

The objectives of this project are to determine the time and space variability of precipitation quality and deposition over a microscale region and to operate one of the eight MAP3S precipitation chemistry network sites. A network encompassing 150 square-km with event samples spaced 1 mile apart was established in central Illinois. Event and subevent precipitation and aerosol sampling for major ions and pH are being conducted. Precipitation chemistry and aerosol composition data will be interpreted to improve the parameterization of precipitation scavenging in MAP3S regional transport models and to better quantify the roles of in-cloud and below-cloud scavenging processes.

BIBLIOGRAPHIC REFERENCES: Changnon, S.A. Jr., and R.G. Semonin (eds.), Special Edition for Metromex, J. Appl. Met. 17(5), May 1978.

SUPPORTED BY U.S. Dept. of Energy, Office of Health &
Environmental Research

5.0021, AIRLIFT SUPPORT OF PROJECT ASHCAN

Unknown, U.S. Dept. of Defense, Air Force, Military Airlift Command, *Scott Air Force Base, Belleville, Illinois* 62225 (6544; EX-76-A-28-2935)

The purpose of this effort is for the Air Force to provide aerial recovery capability in support of Project Ashcan in Panama and Alaska.

SUPPORTED BY U.S. Dept. of Energy, Office of Health &
Environmental Research

5.0022, INTERPRETATION OF METEOROLOGICAL SATELLITE DATA

T. Fujita, University of Chicago, School of Physical Sciences, Dept. of Geophysical Sciences, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (8-011; 04-4-158-1 MOD. #9)

OBJECTIVES: To use satellite data in conjunction with other meteorological data for the purpose of learning and understanding the behavior and dynamics of mesometeorological systems, particularly thunderstorm complexes producing tornadoes and other severe weather such as heavy rains, wind, and hail. To develop means of applying satellite data to the problem of very short range forecasts, i.e., 'nowcasting'. To develop techniques and procedures for getting the satellite data into useful form for the meteorologist.

APPROACH: Emphasis in the coming 12 months will be directed toward the first and second objectives with particular attention on those severe weather systems which present special hazards to the public, such as tornadoes, high winds, and heavy rain. Fujita will continue to collect special and conventional ground truth data during and after certain tornado events for the purpose of establishing relationships between the behavior and appearance of cloud tops in satellite imagery to occurrence, intensity and persistence of tornadoes. Conduct research on the data collected during the highly successful Project NIMROD in order to relate satellite-viewed cloudtops with precipitation and windstorms beneath.

PROGRESS: Produced a 'Manual of Downburst Identification' which is intended to aid the operational meteorologist in distinguishing downburst damage from tornado damage, in identifying situations of downburst potential using radar and satellite data, and in understanding, generally, the behavior and characteristics of downbursts. From several detailed studies of SMS/GOES IR data he has observed a tendency for rapid anvil growth just prior to the downburst with a cessation of anvil growth as the downburst begins and cloud top warming near and during downburst occurrence. Fujita anticipates that once forecasters and observers distinguish between tornadoes and downbursts that tornado reports will decline markedly. Operated and directed Project NIMROD in the Chicago area and collected a wide variety of data. Many convective systems moved through the network allowing the collection of a great volume of data from RHI and Doppler radars, 315 rain gauges, special serial radiosondes, and both rapid and normal scan pictures from GOES.

SUPPORTED BY U.S. Dept. of Commerce, National
Environmental Satellite Service,
Meteorological Satellite Lab.

5.0023, AN ATLAS OF PALEOGEOGRAPHIC MAPS

A.M. Ziegler, University of Chicago, School of Physical Sciences, Dept. of Geophysical Sciences, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (EAR79-15133)

This action provides continuing support for the completion and publication of a series of paleogeographic reconstructions for thirty time intervals ranging from the late Precambrian to the Recent. The maps will show continental orientations, reconstructed biogeography, climatology, tectonic regime and the economic deposits for each time interval. The location of the continents is based on paleomagnetic measurements and checked by reference to available biogeographic data and plate tectonic considerations. The atlas is a summary and synthesis of present understanding of plate tectonics during Phanerozoic time and will provide a forum for reinterpreting the wealth of data in the geologic literature and will help focus future research.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

5.0024, MICROWAVE SEA SURFACE TEMPERATURE DETERMINATION

P. Gloersen, U.S. National Aeronautics & Space Admin., Office of Space Science, Goddard Space Flight Center, *Greenbelt, Maryland* 20771 (7-141; NA79AA-G-00739)

OBJECTIVE: The objective of this research project is to obtain data sets of microwave measurements of sea surface temperature. These measurements will be made from the NASA CV-990.

APPROACH AND CURRENT PLANS: The CV-990 will be flown during satellite passage (SEASAT-1 and Nimbus-G) and over data buoys and oceanographic ships. This combination of satellite, aircraft, and surface data will enable NOAA to make an assessment of the capability of microwave radiometers to measure sea surface temperature.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic
& Atmospheric Admin., National
Environmental Satellite Service

5.0025, NUTRIENT DYNAMICS IN AMAZON LAKES

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Complete descriptions of rates of supply and loss of nutrients are not generally available for tropical lakes, although dynamics of these nutrients, such as nitrogen and phosphorus, have been identified as the most important processes influencing primary production in these ecosystems. This work involves a 2-year investigation of nutrient cycling in Lake Janauaca, a tropical lake in the central Amazon Basin of Brazil. The most distinctive feature of the lake is that each year it is, to a large extent, drained and flooded by a 10-meter annual water level fluctuation of the nearby Amazon River to which the lake connects by a solitary narrow channel. Three hypotheses are being tested: (1) during the 10-meter rise in water level, the Amazon contributes 75% of the lake volume, direct rainfall contributes 8%, and 17% remains from the previous year; (2) during rising water levels, riverborne nitrate and phosphate are the most important sources of new N and P which involve several hypolimnion-epilimnion exchanges in the lake; (3) by sampling other lakes using satellite remote sensing, it will be shown that data obtained from Lake Janauaca are representative of widespread phenomena throughout the Amazon Basin that significantly influence the biological character of lakes bordering the Amazon River, as well as the geochemistry of the river itself.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Biological Behavioral &
Social Sciences, Div. of Environmental
Biology

5.0026, FIELD-ALIGNED PARTICLE FLUXES AND PARALLEL ELECTRIC POTENTIAL

C.S. Lin, University of Maryland, College Park Campus, Graduate School, *College Park, Maryland* 20742 (NSG 5404)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

5.0027, STUDY OF NATURALLY OCCURRING AND ARTIFICIALLY CREATED F-REGION IRREGULARITIES NEAR ARECIBO

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In recent years, the study of nighttime F-region irregularities at midlatitudes has engaged the attention of both theoreticians and experimentalists. The theoretical efforts have mostly concerned studies of plasma instabilities in the midlatitude ionosphere and computer simulations of the same. Various experimental techniques have also been used to study these irregularities.

This grant funds a program of research focusing on correlated measurements needed to identify the plasma that operate in generating small-scale irregularities in the midlatitude ionosphere. The studies are of both natural and artificial irregularities at Arecibo (where the necessary collection of diagnostic tools can be found).

Continuous measurements of Faraday rotation and amplitude fluctuations at 137 MHz with geostationary satellites will monitor total electron content for wave-like perturbations and scintillations near Arecibo. These observations will be conducted in conjunction with several periods of correlated incoherent scatter measurements of F-region density and transport. Later, when the High Frequency Ionospheric Modification Facility at Arecibo becomes operative in June, 1979, similar data will be obtained within the ionospheric volume heated by the intense modifying radio waves. The formation and decay of these artificial irregularities and, in particular, the power spectrum of irregularities in the scale length range of 0.1 - 1 km and any associated larger scale (approximately 10km) variations will provide insight into the generation of km-scale irregularities.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0028, DESIGN, CONSTRUCTION AND TESTING OF LORAN-C TELEMETRY FROM A DRIFTING BUOY

R.G. Walden, Woods Hole Oceanographic Institution, Dept. of Ocean Engineering, *Main St., Woods Hole, Massachusetts* 02543 (R/E-2)

OBJECTIVES: The measurement of near-surface current transport utilizing Lagrangian techniques provides useful information for use in pollution, fisheries and oceanographic research. We propose to evaluate through experiment the feasibility of tracking a surface drifting buoy equipped with an automatic tracking Loran-C receiver and telemetry transmitter. Present methods use vessels or aircraft requiring frequent sitings. A system using satellites (Nimbus) is currently in use which provides a position accuracy of plus or minus 2 km and requires third party data processing with attendant delays. The proposed system will provide high resolution buoy position data which is immediately available to the user with a position accuracy of better than 500 m. The approach appears feasible at this time because of new developments in automatic Loran-C receivers which will automatically search and lock-on to the signals with no human participation. The receiver selected has a digital output which is compatible to directly modulate an hf transmitter.

ANTICIPATED BENEFITS: The successful development of this system will provide a Lagrangian method of tracking ocean currents within a 200 mile radius of a vessel or shore station. The system is dedicated to the user requiring no third party processing costs or delays in obtaining position information. It is not dependent upon satellite operation but upon a permanent Loran-C system which can provide accurate position fixes (greater than 500 m) any time of day.

Scientists at the Woods Hole Oceanographic Institution (Beardsley) have expressed interest in using such a system south of Bermuda, the Gulf Stream and the Gulf of Maine. The system would likewise be useful to BLM studies of George's Bank and the Georgia Embayment. The NOAA National Marine Fisheries Service PATCH study on Georges' Bank is also a potential user.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic
& Atmospheric Admin., Sea Grant Office

5.0029, SEASAT PROGRAM - DETECTION OF OCEANIC CURRENTS USING SEASAT-A SAR SIGNAL DATA

R.A. Schuchman, Environmental Research Inst. of Michigan, Radar & Optics Division, *P.O. Box 8618, Ann Arbor, Michigan* 48107 (7-926; MO-AO1-78-00-4322)

OBJECTIVE: Investigate techniques for detection of oceanic current motion by measurement of the SAR azimuth Doppler frequency shift by separation from wave orbital and phase velocity effects. Results will be development of algorithms for current measurements using SAR, measurement accuracy estimates, and current velocity maps for the test area.

APPROACH: Experimental sites will be chosen for maximum tidal currents in excess of 3 knots and in some cases greater than 9 knots. The corresponding difference between ebb and flood will be roughly double these values. Stationary land targets, located near the ocean test sites, will be measured to obtain a reference for the Doppler shift data. Doppler information from over-the-ocean test sites will be examined and measured for both SEASAT and aircraft cases. A correction algorithm that accounts for spacecraft yaw, pitch and roll will then be developed and applied to the SEASAT Doppler frequency scans and aircraft data. The land and sea Doppler frequency scans from SEASAT and aircraft will be examined for detection and measurement of a Doppler shift. The velocities obtained from aircraft X- and L-band wavelengths will be compared to SEASAT L-band velocity measurements. Finally, the radar current values will be compared to sea truths surface current maps of the site areas.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic
& Atmospheric Admin., National
Environmental Satellite Service

5.0030, MEASUREMENTS OF DIFFERENTIAL CROSS-SECTION OF SECONDARY ELECTRONS EJECTED FROM ATMOSPHERIC GASES BY ELECTRON IMPACT

T.W. Shyn, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Atmospheric & Oceanic Sciences, *Ann Arbor, Michigan* 48104 (ATM79-01618)

An important process in the upper atmospheres of planets is the interaction of electrons with neutral atoms and molecules. The interaction consists of elastic and inelastic scattering processes including ionization of the particles by electron impact. Electrons, particularly those produced as a result of ionization of atmospheric gases, lose their energy principally in inelastic collisions and elastic collisions, and eventually become a part of the thermal electron population at the end of the cascade energy loss process. The understanding of the energy deposition (energy lost) by energetic electrons in a particular gas or mixture of gases requires a comprehensive and consistent set of cross-sections describing the primary and subsequent (secondary) events taking place in the bombarded gas.

Reliable comprehensive experimental data on the angular and energy distributions of secondary electrons are required to understand the energy transfer processes in the upper atmosphere and to calculate the overall energy budget in the atmosphere. The long-term goal of the studies funded here is to develop complete and accurate sets of scattering cross-sections for electron impact on gases characteristic of planetary atmospheres. These cross-sections are necessary to understand the energy budget in these atmospheres. This grant funds this task for the gases N2, O2, NO, CO, CO2, H2, He, CH4, using a crossed-beam technique.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0031, IMPLEMENTING REMOTE SENSING CAPABILITIES IN MANAGEMENT OF WATER AND WETLAND RESOURCES

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OBJECTIVES: First Year: 1) Compare the U.S. Fish and Wildlife Service Wetland classification standards with the Michigan Land Cover/use Classification System to determine the degree to which the Michigan system is adaptable to the newer standards. 2. Determine and document the utility of LANDSAT data as a data source for water and wetland inventory and monitoring in Michigan, based on needs of state-level managerial personnel.

Second Year: 1. Assess the utility of LANDSAT-C thermal data in detecting upwelling and current patterns in large lakes. Use of such data in verifying existing circulation models for large lakes would be included.

ANTICIPATED BENEFITS: Two primary results are expected. First, a clear understanding of the differences between the new U.S. Fish and Wildlife Service wetland classifications and the Michigan Land Cover/use Classification System will be obtained. Second, the utility of LANDSAT data as a data source for wetland inventory in support of wetland managers will be more completely defined.

The data and experimental results, as well as the procedural steps involved in implementing a wetlands monitoring system, will be useful as input for: a) Coastal and inland wetland management programs, including the National Wetlands Inventory. b) Determinations of the impact of wetland removal by construction, agriculture or dredging activities.

IDENTIFIED BENEFITS TO DATE: Our on-going review and correlation of available information on remote sensing of water and wetland resources have shown several areas in which specific work is needed under Great Lakes conditions. Those affecting the design of a water and wetland information system responsive to the needs of water and wetland managers are considered most important. Efforts have been directed towards elucidating timely and cost-effective remote sensing methods of assessing wetland quality, shore erosion, and lake circulation patterns. A compilation of this information is in draft form, and it is anticipated that a substantial managerial community will make use of this document upon publication. We have prepared an audio-visual presentation that will be used to convey the results of the above review to decision-makers, and plan to deliver that presentation to state and local authorities starting in February.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic
& Atmospheric Admin., Sea Grant Office

5.0032, EARTH RESOURCES SYNTHETIC APERTURE RADAR APPLICATIONS DEVELOPMENT WORKING GROUP

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SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lyndon B. Johnson Space Center

5.0033, ANALYTICAL, EXPERIMENTAL, AND MODELLING STUDIES OF LUNAR ROCKS AND THEIR ORIGINS

L.A. Haskin, Washington University, School of Arts & Sciences, Dept. of Earth & Planetary Sciences, *4559 Scott Ave., St. Louis, Missouri* 63130 (EAR79-08762)

This is a continuation of work previously supported by NASA which has been transferred to NSF.

This work is concerned mainly with chemical aspects of evolution of lunar and planetary crusts and regoliths and trace element behavior during igneous differentiation of planetary bodies.

We will analyze mineral and lithic fragments from lunar and terrestrial rocks to help determine the trace-elements compositions of the parent rocks and their sources. We will analyze suites of terrestrial basalts as part of the LSI Basaltic Vulcanism project; these samples will be studied by a variety of techniques by other investigators. We will continue measurements of distribution coefficients and EPR and electrochemical measurements of behavior of trace elements in silicates.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

5.0034, AERIAL REMOTE SENSOR DATA COLLECTION, PROCESSING, AND ANALYSIS FOR ENVIRONMENTAL MONITORING

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OBJECTIVE: Provide continuing on-site, nonpersonnel services support to the remote sensing program operational and research/development at the EPA Environmental Monitoring and Support Laboratory-Las Vegas.

APPROACH: Remote sensor data acquisition, reduction and processing image analysis, and preparation of output products. Work in electronic data processing concerns technique development and the operation and maintenance of the digital image analysis system. Support is provided in the development of active type airborne monitoring systems.

PROGRESS: The contractor is presently completing the project's fifth year of support.

SUPPORTED BY U.S. Environmental Protection Agency,
Office of Research & Development,
Environmental Monitoring & Systems
Lab.

5.0035, TROPHIC CLASSIFICATION OF LAKES UTILIZING CONTACT AND LANDSAT DATA

D.H. Boland, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab., Water & Land Quality Branch, *P.O. Box 15027, Las Vegas, Nevada* 89114 (J613A-023)

OBJECTIVES/APPROACH: Determine the feasibility of assessing the trophic condition of lakes using a combination of LANDSAT multispectral scanner data and contact-sensed data. Specific objectives include: 1) development and evaluation of models to predict lacustrine trophic state, 2) development and evaluation of models to estimate specific trophic indicators, 3) evaluation of LANDSAT's capability for estimating lake surface area, and 4) generation and evaluation of thematic photo maps which depict specific trophic indicators and trophic state. Water quality data were collected from ten Colorado lakes concurrently or near-concurrently with overflights of LANDSAT and NASA aircraft. Aircraft-borne instrumentation included a modular multispectral scanner and metric cameras loaded with color and false color infrared film. LANDSAT MSS and M2S digital data were computer-processed at the Jet Propulsion Laboratory. A trophic state index was developed using the contact-sensed water quality data. Regression models were developed, using MSS and M2S data, to estimate trophic state and selected trophic state indicators. LANDSAT lake surface estimates were compared to those derived from the aerial photography. Thematic photo maps were computer-generated using water truth-scanner data relationships.

FINAL OUTPUT: A report describing the project results will be used by state and federal monitoring agencies.

PROGRESS: Trophic ranking of Colorado lakes using LANDSAT and NASA Overflight data compared favorably to rankings obtained using contact-sensed data. Several problem areas were defined for further investigation. Publication of the project report is projected for June 1979.

Project report, 'Trophic Classification of Selected Colorado Lakes: Lake Classification through the Amalgamation of Contact-Sensed Data and Digitally Processed Multispectral Scanner Data Acquired by Satellite and Aircraft' was jointly published with NASA, Office of Space and Terrestrial Applications, Environmental Observations Division, Washington, D.C.

SUPPORTED BY U.S. Environmental Protection Agency,
Office of Research & Development,
Environmental Monitoring & Systems
Lab.

5.0036, CLIMATIC AND PHONOLOGICAL MODELS FOR RESOURCE PLANNING AND MANAGEMENT

R.O. Gifford, University of Nevada, Reno Campus, School of Agriculture, Dept. of Plant Soil & Water Science, *Reno, Nevada* 89507 (177774 (HRB NO.))

The following tasks will be accomplished: 1. Develop techniques for extending data from limited station locations to areal coverage. 2. Develop techniques to forecast long-term series of events from short-term records. 3. Describe interrelationships between climatic variables. **APPROACH**: The statistical descriptions of climatic data made under project W-48 will be reexamined for their application to locations other than those for which the data was originally analyzed. Patterns of precipitation at three or more locations will be compared using statistical comparison techniques. Where the patterns are not significantly different they will be used to interpolate the precipitation pattern for locations between them. The minimum amount of local information needed to describe the precipitation pattern using surrounding patterns will be sought using trial and error methods. Similar analyses will be made for temperature patterns. Using the same data base, the length of record required to establish the time pattern of climatic data will be explored by comparing short- and long-term records at a variety of locations. The combined occurrence of climatic elements examined by statistical studies of the precipitation, temperature, solar radiation, and possibly other parameters. The combined occurrences will also be summarized and analyzed in models for potential evapotranspiration and water balance.

SUPPORTED BY University of Nevada

5.0037, USE OF AIRCRAFT SPECTRORADIOMETRY TO DETERMINE WATER QUALITY

H.L. McKim, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *P.O. Box 282, Hanover, New Hampshire* 03755 (31583)

OBJECTIVE: To quantitatively assess water quality parameters in fresh and salt water regimes utilizing aircraft spectroradiometer data and to conduct laboratory tests to determine spectral bands of interest for quantitative and qualitative measurement of water quality data to meet Corps of Engineers requirements.

APPROACH: A prototype 500-channel aircraft spectroradiometer instrument with a 10 Angstrom units spectral resolution will be used in the study to assess water quality parameters in fresh and salt water systems. The instrument provides a digital tape read-out for 500 channels ranging from the visible (0.42 microns) to the near infrared wavelengths (1.0 micron) for a minimal 60 by 60 ft. area. Laboratory testing to determine spectral bands of interest will be conducted with the airborne spectroradiometer instrument. The results will be compared to field tests in FY 78 run. Aircraft spectroradiometer flights over selected test site areas will be accomplished in conjunction with ground truth data acquisition. Analysis of the high resolution multispectral data will be used to qualitatively and quantitatively assess water quality parameters, especially turbidity, based on correlation to field measurements.

In addition, the GISS theoretical model will be run with data taken in 1978. Spectral response curves will be generated based on varying the size, optical properties and density of particulate matter. Results from the 1978 aircraft flight analyses and laboratory experiments will be compared to conventional techniques. A cost-effective comparison between conventional techniques and aircraft spectroradiometry to assess quality parameters in fresh and salt water will be made. Procedures to assess water quality will be made for use by Corps of Engineers Division.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers,
Cold Regions Research & Engineering
Lab.

5.0038, NUMERICAL SIMULATION OF THE NEW YORK BIGHT COASTAL WATERS

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OBJECTIVES: The objective is to construct an advanced, three-dimensional hydro-numerical model which will accurately predict the dynamic and thermodynamic properties of Atlantic coastal waters in response to tidal, surface wind, heat and salinity forcing.

ANTICIPATED BENEFITS: The model will be verified by comparing predictions with N.Y. Bight oceanographic data collected under the NOAA MESA Program. Thereafter, the model can be applied to the prediction of pollutant dispersion and bottom sediment transport; it should then be extended to include ecosystem models.

IDENTIFIED BENEFITS TO DATE: 1.) A published report entitled, 'The Middle Atlantic Bight: A Climatological Atlas of Oceanographic Properties'. 2.) Analysis and simulation of tides. 3.) Simulation of a climatological year for the Middle Atlantic Bight.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic
& Atmospheric Admin., Sea Grant Office

5.0039, FLOW BEHAVIOR OF EXTRATERRESTRIAL MATERIALS

L.C. Klein, Rutgers the State University of New Jersey, Busch Campus, Graduate School, *Piscataway, New Jersey* (EAR79-06771)

This task was originally funded by NASA but has been transferred to NSF for continued support. This study focusses on the viscous flow behavior of extraterrestrial materials - both lunar and meteoritic materials. This study includes an experimental investigation of the effects of oxygen fugacity on flow behavior in lunar materials, such as glassy soils, and in meteoritic materials, such as breccia fragments in howardites, as well as in the Fe-Si-O system. The flow behavior is observed over a wide range of temperatures and oxygen fugacities in order to identify structural aspects of iron-containing silicates, and to evaluate effects of solute redistribution on crystal growth. Experimental measurements are extended to include the intermediate temperature region in glasses that do not crystallize readily. A semi-empirical model is being formulated to describe flow in the high viscosity region. It is expected that this study will lead to a better understanding of the flow process in iron-containing silicate materials in a variety of environments.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

5.0040, PREPARATION FOR 1979 SOLAR ECLIPSE

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The technical objective is to prepare sets of rocket-borne experiment packages and take care of all logitical considerations necessary for the conduct of the 1979 Solar Eclipse Field Measurements Program.

A detailed experimental plan involving many coordinated experiments is organized for the total solar eclipse on 26 February 1979. The experiments will focus on the measurements of atmospheric response in the 60-90 km altitude region.

SUPPORTED BY U.S. Dept. of Defense, Electronics
Research & Development Command,
Atmospheric Sciences Lab.

5.0041, AEROBIC BIOLOGICAL WASTE TREATMENT FOR CLOSED ECOLOGICAL LIFE SUPPORT SYSTEMS

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SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

5.0042, THE METEOROLOGICAL VARIATION OF ANTARCTIC AEROSOLS

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During the austral summer of 1979-80 and 1980-81, measurements will be made at South Pole Station in Antarctica of the concentrations of aerosols, ozone, carbon dioxide, and other trace chemical constituents at the surface of the ice cap and up to the katabatic return flow above the inversion. In addition, during the austral summer of 1980-81, airborne measurements of aerosols, ozone, and meteorological parameters will be made over Antarctica using a science configured LC-130 logistics aircraft.

These measurements will be used to obtain an improved understanding of (1) the physical properties of and precipitation mechanisms for atmospheric aerosols over the antarctic plateau, and (2) the meteorological processes which transport aerosols to the plateau.

Logistics support is required for two scientists in austral summers of 1979-80 and 1980-81.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Polar Programs

5.0043, NON-NUCLEAR POLLUTANTS IN STRATOSPHERIC AIR

E.P. Hardy, U.S. Dept. of Energy, Office of Health & Environmental Research, Environmental Measurements Lab., *376 Hudson St., New York, New York* 10014 (1783)

The objectives are to document the concentrations of selected stable tracers (particulate and gases) in the stratosphere as a function of latitude, altitude and season; to inventory the stratospheric burdens of these materials; to examine vertical transport in the troposphere; to develop and test stratospheric transport models; and to supply basic data for other scientific programs in studying the ultimate deposition of tracers in the environment. Particulate and gas sampling is conducted by both aircraft (Project Airstream) and balloons (Project Ashcan) in the stratosphere on a seasonally repetitive basis in the northern hemisphere. Aircraft sampling extends from 75 degrees N to the equator at four altitudes up to 63K ft. and balloons are launched in Alaska, Panama and New Mexico to 70, 80, and 90K ft. Data and interpretive analysis are routinely published and distributed to all member nations through the United Nations.

SUPPORTED BY U.S. Dept. of Energy, Office of Health &
Environmental Research

5.0044, OCEAN REMOTE SENSING

G.S. Brown, Applied Science Associates Inc., *Apex, North Carolina* 27502 (DN975312; N00014-79-C-0198)

Precision radar altimeters carried by satellite offer the possibility of measuring and monitoring low amplitude variations in sea level which are indicators of ocean frontal boundaries, geostrophic currents, and subsurface eddy positions. This program will analyze the feasibility of extracting these oceanographic signals from the much larger signal caused by variations in geoid heights, and test the calculations against observed ocean data.

Theory will be developed for relating ocean wave-wave-interaction to the modulation of short capillaries which are responsible for the altimeter signal return. An empirical study of change in backscatter as the satellite passes over frontal boundaries measured in-situ will also be conducted.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of
Naval Research

5.0045, UTILIZATION OF RANGE DIFFERENCE OBSERVATIONS IN GEODYNAMICS

I.I. Mueller, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Geodetic Science, *164 W. 17th Ave., Columbus, Ohio* 43210 (NAS 5-25888)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

5.0046, EXAMINATION OF REQUIREMENTS AND METHODS FOR REPORTING ATMOSPHERIC INFORMATION

J.K. Leurs, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (NAS 8-33369)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
George C. Marshall Space Flight Center

5.0047, REMOTE SENSING APPLICATIONS TO OKLAHOMA RESOURCES AND ENVIRONMENTAL PROBLEMS

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SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Office of Space & Terrestrial
Applications

5.0048, FEASIBILITY OF GOES DATA RELAY SYSTEM IN THE U.S. GEOLOGICAL SURVEY'S WATER DATA COLLECTION PROGRAM

G.L. Gallino, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Portland, Oregon* (OR 76-079)

Real-time water data are needed in the Pacific Northwest to manage, plan, and develop its water resources in support of hydroelectric-power development, flood control, pollution control, irrigation, and wildlife management. Indivdual agencies are installing their own systems at gaging stations operated by the U.S. Geological Survey. However, use of so many different 'real-time' systems reduces operation efficiency. There is need for an efficient system for use by all. The Geostationary Operational Environmental Satellite (GOES) could provide such a system.

Use the GOES system as a telemetry supplement to existing data-collection facilities to improve the real-time data-collection system. Evaluate the impact of such a real-time system on the WRD program and determine costs and benefits. Develop computerized data-verification programs and appraise the effectiveness. Compare the accuracy of GOES-acquired data to data acquired by conventional methods.

Use the Bull Run and Sandy River Basins as a test area for the system. The 107-square-mile area is the watershed for the Portland Municipal water supply. Instruments will be installed at one site for stream-stage turbidity and precipitation, three sites for stage and turbidity, four sites for stage alone, and two sites for precipitation and air temperature alone. GOES platforms will be installed at each site. The Portland District will manage the system and the Northwest Water Resources Data Center will check verification methods.

The 10 GOES satellite platforms operated reasonably well during the past year. A letter summarizing progress made toward the objectives: (1) to evaluate the impact of the system on District operations, (2) to determine cost benefits, (3) to develop a computerized verification system and to compare the accuracy of GOES-acquired data with conventionally acquired data, was sent to the Instrumentation Group. The project has been terminated.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0049, SYNTHESIS OF REGIONAL CRUST AND UPPER MANTLE STRUCTURE FROM SEISMIC AND GRAVITY DATA

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0050, BLM COOPERATIVE PROJECTS

W.G. Rohde, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, EROS Data Center, Applications Branch, *Sioux Falls, South Dakota* 57198

STATE TO WHICH PROJECT PERTAINS: Arizona.

The overall objective is to evaluate the usefulness of LANDSAT film products, computer-compatible tapes, and aerial photographs at several scales for mapping and inventorying wildland vegetation in Northern Arizona.

Standard and enhanced LANDSAT imagery will be manually interpreted to illustrate the extent to which such techniques can be used to map and inventory the area of vegetation communities.

Digital LANDSAT data will be classified to stratify the project area into broad vegetation categories. This stratification will be used to allocate sample units to be photographed with 1:6000 normal color film. Sample units will be allocated proportionately to the area within each stratum. Each aerial photograph will be interpreted and a number of photo plots will be selected, using proportional allocation, and visited on the ground. The photo and ground observations will be used to describe the resource cover types associated with each stratum and to estimate the area of each vegetation cover type.

Digital terrain data will be registered to the LANDSAT data. The terrain data, (i.e., elevation, slope aspect) and the photo data will be used to develop post-classification stratification models to improve the capability of mapping vegetation resources.

SUPPORTED BY U.S. Dept. of the Interior, Land Information & Analysis Office, EROS Data Center

5.0051, APPLICATION OF SATELLITE AND AIRCRAFT IMAGERY TO HYDROGEOLOGY

G.K. Moore, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Sioux Falls, South Dakota* (CR 73-196)

Remote sensing has considerable potential for hydrologic studies, particularly in the visible, infrared, and microwave parts of the spectrum. It offers new information and new tools to the hydrologist and can reduce the field work necessary in conventional studies. Research, testing, and development are needed to obtain operational procedures, however.

(1) Conduct research on the applications of remote sensing to ground-water occurrence, surface drainage characteristics, and water color and turbidity. Develop application examples. (2) Develop enhancement and interpretation procedures for remote sensing imagery and digital data, using both manual and computer processing. (3) Train and consult with other hydrologists on feasibility tests and operational uses of remote sensing. (4) Originate, plan, and coordinate programs and projects in remote sensing.

(1) Analyze existing data for hydrologic information; develop procedures for information extraction. Evaluate effects of atmosphere and soil and vegetation cover. (2) Evaluate existing procedures for manual and digital processing. Determine need and utility of new procedures. (3) Conduct training courses and briefings. (4) Work with WRD, EROS, and NASA personnel to originate and coordinate remote sensing applications to hydrologic problems.

Talks, briefings, and training lectures were given at EROS Data Center, Natl. Space Technology Labs, SD State Univ., Murray State Univ., and one WRD District. A formal paper was presented at the World Water Conference in Mar del Plata, Argentina. Work on the Yampa Basin and Johnstown flood was completed and underway, respectively. Research on water color and turbidity was completed. Personnel from five districts were given training in digital processing of LANDSAT data.

Conduct training courses in hydrologic remote sensing. Begin research on relationship of source areas to stream flows. Continue work on Johnstown flood. Prepare formal paper on water turbidity. Continue training in digital processing. Prepare lecture notes for training courses.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Water Resources Div.

5.0052, SOLAR-WIND AND MAGNETOSPHERIC ELECTRIC FIELDS AND PLASMAS

J.L. Burch, University of Texas, San Antonio Campus, School of Science & Mathematics, Dept. of Earth & Physical Sciences, *San Antonio, Texas* 78285 (NSG 5418)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0053, IMPACT OF GASEOUS SULFUR AND AEROSOLS PRODUCED BY POWER PLANTS ON THE CCN BUDGET

V.K. Saxena, Utah Higher Education System, University of Utah, School of Science, Dept. of Meteorology, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (7963)

A comprehensive program to study the regional transport and dispersion of sulfur and chlorine particles is proposed. The study is aimed at determining the variability of CCN upwind and downwind of the power plants, investigating the growth and formation of CCN in the plane plume, and determining whether the gaseous sulfur-to-sulfate conversion processes give rise to a secondary maximum in the CCN concentration downwind of the plume. Our newly developed CCN spectrometer will be used. It is capable of producing real-time measurement and display of the entire CCN spectrum within as short a time interval as 15 seconds. Airborne measurements abroad a DC3 aircraft will be made. One of the most fascinating aspects of the proposed study is the utilization of the CCN activity spectrum as a natural tracer of the air mass history. The proposed study will help MAP3S in four respects. First, the submicron cycle and therefore a study of their transport is needed. Second, they represent the fingerprints of a pollution plume in terms of their activity spectrum and are the best tracers of air originating from urban-industrial areas. Third, they have been shown to be derived from the gaseous sulfur-to-sulfate conversion processes and are involved in the acid rain. Fourth, larger sulfate particles directly emitted from power plants may form haze at ambient relative humidities thereby degrading the visibility.

SUPPORTED BY U.S. Dept. of Energy, Office of Health & Environmental Research

5.0054, SEASAT-A COORDINATION AND APPLICATION

D.E. Lichy, U.S. Dept. of Defense, Army, Corps of Engineers, Coastal Engineering Research Center, *Kingman Bldg., Fort Belvoir, Virginia* 22060 (31582)

OBJECTIVE: To coordinate the Corps needs with NASA activities with the SEASAT satellite for the development of remote applications. An overall Corps need exists to develop remote sensing techniques for coastal terrestrial and ice engineering problems and application of these techniques to field problems.

APPROACH: Evaluation and coordination of SEASAT-A application to the Corps needs by research, correspondence, attendance at meetings, participation in seminars and working groups and consulting with SEASAT groups of NASA, other sponsors, Corps Division and District offices, CRREL, WES, ETL, IWR, and Division laboratories. This effort will match the potential capabilities of SEASAT-A with Corps problems and needs.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers,
Coastal Engineering Research Center

5.0055, PETROLOGIC STUDY OF RETURNED LUNAR SAMPLES

E. Roedder, U.S. Dept. of the Interior, Geological Survey, *12201 Sunrise Valley Dr., MS 912, Reston, Virginia* 22092 (EAR79-06760)

This study is a continuation of work previously funded by NASA which has now been transferred to NSF for support. This study is aimed at understanding planetary processes and history through the study of inclusions in selected geological samples. Investigations will be made in the area of understanding the phenomena of trapped melt inclusions in crystallized silicate materials. These studies will assist in interpreting the complex differentiation trends evident in the gross compositions of the host materials as well as those of silicate melt immiscibility. The study has wide application to the area of terrestrial mineralogy and petrology as well as planetary geoscience.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

5.0056, EXTRA-TERRESTRIAL OXYGEN FUGACITIES

M. Sato, U.S. Dept. of the Interior, Geological Survey, National Center, *12201 Sunrise Valley Dr., MS 912, Reston, Virginia* 22092 (9710-01150)

The project is primarily responsible for determining oxygen fugacity values of lunar rocks, meteorites, and other planetary matter to provide basic data on the oxygen fugacities of rocks and minerals in the Solar System. On the basis of these data and other available information such as the behavior of volatile matters, we evaluate the causes and mechanisms of redox reactions that occurred during the formation of planetary bodies and magmatic activities.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0057, REMOTE SENSING/WASTE DISPOSAL

L.C. Rowan, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (9790-02015)

STATES TO WHICH PROJECT PERTAINS: New York, Pennsylvania, Utah, Maine, South Dakota.

The objectives are to delineate landforms using satellite and aircraft images that may reflect subsurface and surface geologic structures. During this year, emphasis will be placed on statistical analysis of identified lineaments to determine regional trends and on detailed field and aircraft image studies of selected lineaments to characterize these features. In both cases, geophysical data, including aeromagnetic maps, seismic profiles, and gravity maps and subsurface stratigraphic data will be used to relate the lineaments to subsurface structures. Ultimately, this approach should permit characterization of large regions where detailed mapping of geophysical and subsurface stratigraphic data are only locally available.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0058, REMOTE SENSING/CUSMAP

L.C. Rowan, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (9790-02074)

STATES TO WHICH PROJECT PERTAINS: Utah, Nevada, Arizona, Missouri.

Emphasis will be placed on compilation of digital image processing of LANDSAT images for mapping lineaments and other landforms and limonitic hydrothermally altered rocks. Analysis of these data involves both photointerpretative and statistical methods to identify the most significant features for localization of ore deposits. High-altitude aircraft photographs and other images will be used to supplement the LANDSAT data. Results will include maps showing the distribution of lineaments and limonitic altered rocks which later will be integrated with other geophysical, geochemical, and geologic field mapping data. Another important aspect of these investigations is the acquisition, processing, and analysis of multispectral aircraft data for overcoming some of the limitations imposed by the spectral bands used in the LANDSAT scanner.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0059, OXYGEN FUGACITIES OF EXTRATERRESTRIAL MATERIALS AND REDOX REACTIONS

M. Sato, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Experimental Geochemistry & Mineralogy Branch, *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (EAR79-08578)

This work is a continuation of studies previously funded by NASA but which have been transferred to NSF. The project is primarily responsible for determining oxygen fugacity values of lunar rocks, meteorites, and other planetary matter to provide basic data on the oxygen fugacities of rocks and minerals in the Solar System. On the basis of these data and other available information such as the behavior of volatile matters, we evaluate the causes and mechanisms of redox reactions that occurred during the formation of planetary bodies and magmatic activities.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

5.0060, LAND USE CHANGE DETECTION AND MAP UPDATE

V.A. Milazzo, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, *12201 Sunrise Valley Dr., Mail Stop 710, Reston, Virginia* 22092 (G-25)

Conduct actual test and demonstration studies in select area(s) using approaches and techniques of change detection and map update previously recommended. Investigate the interpretive and cartographic aspects in identifying and mapping land use changes and in selectively updating land use maps. Establish standard procedures and techniques to be used by compilers in updating land use and land cover maps.

Refine criteria and procedures for selecting areas for land use update. Begin preliminary development of a workable set of standard and routine guidelines for update selection that can be used in an operational map update program.

Begin evaluation of likely candidate areas for map update in a first-round update program. Consider use of LANDSAT for targeting areas for possible update. Conduct search of available remote sensing sources and explore opportunities for new photo source acquisition under proposed Federal High-Altitude Photography Program as well as improved techniques in the use of LANDSAT digital data for change detection and map update. Establish preliminary areas for map update.

Continue to work with Topographic Division, state and regional cooperators and NASA in the areas of land use change detection and map update already developed and pursue areas of further cooperation.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Land Information & Analysis
Office

5.0061, RESEARCH AIRCRAFT OPERATIONS

C.L. Simpson, U.S. Dept. of Energy, Battelle Pacific Northwest Lab., *P.O. Box 999, Richland, Washington* 99352 (000556; EY-76-C-06-1830)

The purpose of this program is the provision of technical support for DOE-DBER Atmospheric Research programs, in the form of airborne laboratories and tracer-release facilities. Aircraft support is required especially for the following Atmospheric Sciences programs: Precipitation Scavenging, Atmospheric Boundary Layer Studies, Particle Resuspension and Translocation, Cooling Tower and Cooling Pond-Atmospheric Impact, Aerosol and Trace Gas Transformation, and Urban Pollution and Tracer Studies. Two aircraft, a Cessna-411 and a Douglas DC-3, have been equipped with tracer release facilities as well as the necessary instrumentation for highly sophisticated measurements of cloud physics, aerosols, pollutant-gases, atmospheric tracers, and turbulence.

SUPPORTED BY U.S. Dept. of Energy, Office of Health &
Environmental Research

5.0062, POLAR ICE REMOTE SENSING

W.J. Campbell, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Tacoma, Washington* (WR 70-064)

One of the fastest varying large-scale features on the earth's surface is sea ice. Theoretical studies show the ice canopy in polar regions to be of major importance in (1) determining the global heat balance, and (2) determining the vapor flux of water into temperate regions. In order to test the developing numerical models of polar regions it is necessary to acquire sequential large-scale synoptic data over polar regions. Remote sensing, especially in frequencies in the microwave range, appears to offer the best chance of obtaining these data.

As investigators for Sea Ice for NASA and the Spacecraft Oceanography Center-NOAA, we will design polar remote sensing experiments using NASA and other agency remote sensing aircraft and satellites. Aircraft and satellite experiments will be coordinated with necessary ground truth networks for the remote sensing systems. The basic premise for these plans will be to develop the correct remote sensing means to acquire data that will be useful in testing numerical models of sea ice and glacier ice.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Water Resources Div.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, MORPHOMETRICS OF CELLULAR DAMAGE IN MICE RECEIVING WHOLE BODY IRRADIATION

W.J. Sapp, Tuskegee Inst., School of Arts & Sciences, Dept. of Biology, *Tuskegee Institute, Alabama* 36088 (NCC 2)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

6.0002, OXYGEN EFFECTS AND EARLY BIOCHEMICAL EVOLUTION - ACETYL-COA SYNTHETASES IN YEAST

J.A. Neptune, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NCC 2)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

6.0003, INVESTIGATION ON PROCHLORON - A PROKARYOTIC GREEN ALGA

E.C. Weaver, California State University & Colleges, San Jose State University, School of Science, Dept. of Biological Sciences, *Washington Sq., San Jose, California* 95192 (NCA 2-675910)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

6.0004, CARDIOVASCULAR DECONDITIONING AND EXERCISE PERFORMANCE

R.F. Debusk, Stanford University, School of Medicine, Dept. of Medicine, *Stanford, California* 94305 (NCA 2-745911)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

6.0005, MATCHING CROP VARIETIES TO EFFICIENT USE OF NITRATES, AMMONIUM AND UREA FOR THE CONTROLLED ECOLOGY LIFE SUPPORT SYSTEM (CELSS)

R.C. Huffaker, University of California, Davis Campus, School of Agriculture & Environmental Sciences, Dept. of Agronomy & Range Science, *Davis, California* 95616 (NSG 2406)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

6.0006, SYSTEM FOR ASSESSMENT OF 24-HOUR BIORHYTHM DESYNCHRONOSIS AND ITS EFFECTS ON PERFORMANCE AND PSYCHOLOGICAL STATE (ABBREV)

L.F. Chapman, University of California, Davis Campus, School of Veterinary Medicine, Dept. of Behavioral Biology, *Davis, California* 95616 (NCA 2-180905)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

6.0007, HEAT RESISTANCE OF MICROORGANISMS

J.E. Campbell, U.S. Dept. of Health Education & Welfare, Public Health Service, Food & Drug Admin., Bureau of Foods, *200 C St. S.W., Washington, District of Columbia* 20204 (04068)

STATEMENT OF OBJECTIVES: a. Provide technical support and advice on the efficacy of sterilization cycles and the expected microbiological loading on spacecraft components to the Chief, Planetary Biology Program; and b. conduct research on the mechanism of thermal inactivation of microorganisms and investigate ways and means of improving the effectiveness of sterilization cycles.

DESCRIPTION OF WORK: 1. Determine the heat resistance of B. megaterium, B. cereus, Cl sporogenes and an unknown soil anaerobe in the closed can system. An attempt will be made to develop predictive models based on time, temperature and humidity. 2. Examine the possibility that a measure of the internal osmotic pressure of the spore can be related to thermal resistance. 3. Determine the thermal resistance of S. typhimurium, S. senftenberg 775W in the can system and specifically constructed oven at one or more temperatures. At least 8 relative humidities will be examined.

SUPPORTED BY U.S. Dept. of Health Education & Welfare,
Food & Drug Admin., Bureau of Foods

6.0008, ENVIRONMENTAL INTERACTIONS WITH THE AGING PROCESS

G.A. Sacher, U.S. Dept. of Energy, Div. of Biological & Medical Research, *9700 S. Cass Ave., Argonne, Illinois* 60439 (001541; W-31-109-ENG-38)

This program is concerned with the effects of environmental pollutants on the daily (diel) cycles of energy metabolism, motor activity, and body temperature in small rodents. These processes can be measured accurately and continuously on unrestrained animals. The hypothesis is that they are sensitive indicators of the health status of the animal, including expectation of disease morbidity and survival. We have gone a considerable way toward validating this hypothesis, and are beginning to investigate the effects of specific pollutants. The purpose is, first, to characterize the effects of each pollutant, and second, to determine whether these effects predict the subsequent health history of the animal. Energy-related pollutants currently under examination are ionizing radiations, ingested lead, and high-voltage electric fields. Diel cycles of metabolism, activity, and temperature can be logged continuously and automatically for several individual mice simultaneously for periods up to 2 weeks. The search for indicator variables has thus far been limited to the energy expenditure variable, and has revealed 3 variables that predict the length of life, i.e., resting metabolic rate (negative correlation), ratio of average to resting metabolic rate (positive correlation), and change of metabolic rate from youth to old age (negative correlation). The search must now be extended to the activity and temperature variables, which have become functional only recently. The initial phase of work with pollutants will be focused on radiation variables both ionizing and non-ionizing. The non-ionizing radiations to be examined are 60 Hz electric fields and 2450 MHz microwaves, as produced by the proposed Solar Power Satellite system.

BIBLIOGRAPHIC REFERENCES: Sacher, G.A., P.H. Duffy and E. Stafeldt, Genetic Relation of Life-Span to Metabolic Rate for Five Mouse Strains and Their Hybrids, Fed. Proc. 37: 716(1978). Sacher, G.A., Longevity, Aging, and Death: an Evolutionary Perspective, The Gerontologist 18: 112-119(1978).

SUPPORTED BY U.S. Dept. of Energy, Office of Health &
Environmental Research

6.0009, PLANT DIVERSITY TO SUPPORT HUMANS IN A CONTROLLED ECOLOGY LIFE SUPPORT SYSTEM GROUND-BASED DEMONSTRATOR

J.E. Hoff, Purdue University, School of Agriculture, Dept. of Horticulture, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (NSG 2401)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

6.0010, HIGHER PLANT SPECIES SELECTION CRITERIA FOR A CLOSED ECOLOGICAL LIFE SUPPORT SYSTEM - PHOTOSYNTHETIC AND NUTRITIONAL ASPECTS

C.A. Mitchell, Purdue University, School of Agriculture, Dept. of Horticulture, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (NSG 2404)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Headquarters

6.0011, DEVELOPMENT OF A PROTOTYPE EXPERIMENT FOR TREATING CELSS AND PCELSS WASTES TO NUTRIENTS FOR PLANT GROWTH

M. Modell, Massachusetts Inst. of Technology, School of Engineering, Dept. of Chemical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 2403)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

6.0012, PLANT CHARACTERISTICS FOR CONTROLLED ECOLOGY LIFE SUPPORT SYSTEM AND STUDY OF PHYSIOLOGICAL INJURIES TO PLANTS (ABBREV)

T.W. Tibbitts, University of Wisconsin, Madison Campus, School of Agriculture & Life Sciences, Dept. of Horticulture, *Agriculture Hall, Madison, Wisconsin* 53706 (NSG 2405)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, COMPUTERIZED SAFETY INFORMATION SYSTEM FOR GSFC'S HEALTH AND SAFETY ENGINEERING OFFICE

H.D. Cabassa, University of Puerto Rico, Mayaguez Campus, Graduate School, *Mayaguez, Puerto Rico* 00708 (NAS 5-25844)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

7.0002, NRL-1 STRATOSPHERIC GLOBAL PREDICTION MODEL

M.R. Schoeberl, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880271)

To provide the Navy with a numerical model of the middle atmosphere which is computationally efficient and capable of being coupled with the Navy's tropospheric prediction model to generate suitable upper boundary conditions and predict stratosphere-troposphere interactions.

A quasigeostropic model developed by Schoeberl (1976) is being used to investigate stratospheric large-scale dynamics and troposphere-stratosphere coupling. The NRL version of the Canadian spectral primitive equation model developed originaly by Daley et al. (1976) will be used to investigate nongeostropic coupling.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air
Systems Command

7.0003, APPLICATIONS OF BIFURCATION THEORY

J.F. Auchmuty, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Mathematics, *Memorial Hall, Bloomington, Indiana* 47401 (MCS78-00952 A01)

This continues research previously supported by NSF MCS78-00952.

Professor Auchmuty will study the analysis and modelling of certain nonlinear phenomena in astronomy, biology, chemistry and chemical engineering. The problems include various aspects of the theory of reaction-diffusion and interaction-diffusion equations, especially the theory of bifurcating waves. Also he will continue his work on bifurcation problems in astronomy and celestial mechanics and related mathematics.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Mathematical &
Computer Sciences

7.0004, ELECTROMAGNETIC SCIENCES COMPUTATIONS AND MATHEMATICAL ANALYSIS

Schneeberger, R D P Inc., *Waltham, Massachusetts* (DF903230; F19628-77-C-0242)

1. The objective of this effort is the support of in-house research programs in the fields of electromagnetic sciences including tropospheric scattering radar and antenna techniques, microwave acoustic devices, and ionospheric physics problems. 2. The product of this contract will be mathematical, numerical and/or graphic solutions as well as graphic representations to data furnished. Completed art work must be of sufficiently high quality to be used for publication in technical journals.

Data reduction and/or mathematical analysis related to electromagnetic sciences problems, curve plotting, drafting and artistic creative illustrations from experimental and theoretical scientific data, or tracing of machine-produced curves, as well as free-style artistic illustrations of concepts, apparatus or devices. Some of the work will be block and circuit diagrams, lettering and 3-dimensional pictorial representations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome
Air Development Center

7.0005, MATHEMATICAL SCIENCES POSTDOCTORAL RESEARCH FELLOWSHIP

G.B. McFadden, (No Performing Organization Reported), *New York* (MCS79-19143)

The research will involve the area of applied mathematics, particularly the computer design of 3-dimensional swept wing configurations with low wave drag.

The Fellowship Institution will be the Courant Institute.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Mathematical &
Computer Sciences

7.0006, TWO-DIMENSIONAL RECURSIVE DIGITAL FILTERS FOR NEW REAL-TIME IMAGE PROCESSING

W.E. Alexander, University of North Carolina, North Carolina Agricultural & Technical State University, School of Engineering, Dept. of Electrical Engineering, *N. Dudley St., Greensboro, North Carolina* 27411 (NSG 5406)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

7.0007, COMPUTER SCIENCE AND COMPUTER ENGINEERING RESEARCH EQUIPMENT

R.W. Ehrich, Virginia Polytechnic Inst. & State University, School of Arts & Sciences, Dept. of Computer Science, *Blacksburg, Virginia* 24061 (MCS7907032)

A computer system will be acquired to form an interdisciplinary laboratory for remote sensing and image processing. Research will be undertaken on the following topics: Structural-statistical Approaches to the Analysis of Macrotextures. A Facet Model for Low-level Image Processing. Shape Recognition. Spatial Data Structures. Homomorphisms - Exact and Inexact Matching.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Mathematical &
Computer Sciences

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, RESEARCH IN THEORETICAL ELEMENTARY PHYSICS

L. Susskind, Stanford University, Graduate School, *Stanford, California* 94305 (PHY78-26847)

Research will be done in theoretical physics to further our understanding of elementary particles, quantum field theory, and related areas of solid-state physics, statistical mechanics, astrophysics and cosmology. Topics include: 1) Quantum chromodynamics, focussing on questions related to quark confinement, 2) Quantum field theory in environments of extreme temperature, density, or pressure, 3) Elementary particle physics of the very early universe, and 4) Dynamical mechanisms for symmetry breaking-in theories of the electro-weak force.

This is the first year of a four-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0002, ELECTROMAGNETIC PROPERTIES OF LAYERED SUPERCONDUCTING STRUCTURES

M.R. Beasley, Stanford University, School of Humanities & Sciences, Dept. of Applied Physics, *Stanford, California* 94305 (DMR79-11117)

Research supported under NSF Grant DMR75-04368 will be continued and extended. This research involves a comprehensive experimental effort to fabricate, characterize and study the superconducting properties of layered and quasi-two-dimensional superconductors. Materials of interest include the naturally occurring layered compounds, artifically layered composities and very thin films. The relationship between the layered and/or two-dimensional nature of such superconductors and their electromagnetic properties will be investigated. Particular emphasis will be placed on detailed studies of the critical magnetic fields and critical current densities of such systems, the effect of layering on the superconducting transition temperature, and the onset of resistance in two-dimensional superconductors.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0003, MATERIAL SUPPORT TECHNOLOGY - TUNNELLING INVESTIGATION OF QUASI-ONE-DIMENSIONAL MATERIALS

P.M. Chaikin, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DN675684; N00014-76-C-1078)

The Navy has need for new electronic materials that offer improved performance in operational systems. This program will provide needed information on the electronic properties of a class of materials that holds promise for such increased capabilities in communications and surveillance.

The investigator will use electron tunnelling to investigate a series of quasi-one-dimensional materials of considerable current interest. These materials fall into the categories of polysulfur nitride, the charge transfer salts based on tetracyano-quinodimenthane (TCNQ), and metallo-organic salts based upon platinum cyanide (KCP). All have unusually anisotropic electronic and vibrational properties and undergo phase transitions at low temperatures that are associated with Peierl's distortions. Studies in polysulfur nitride will focus on the temperature dependence of the superconducting energy gap while those in the TCNQ salts will initially focus on the phase transition.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of
Naval Research

8.0004, EXPERIMENTAL STUDIES OF CRITICAL SYSTEMS

D.S. Cannell, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Physics, *Santa Barbara, California* 93106 (DMR79-10030)

Accurate light-scattering measurements of the static and dynamic properties of a model critical fluid, xenon, at temperatures very near its critical point, will be performed in order to observe slight corrections to asymptotic scaling. Sound velocity studies on the same model system, together with the correlation-range data obtained from the first experiments, will be used to compare sound speed and attenuation with theory. A light-scattering study of spinodal decomposition will also be performed in a binary fluid mixture chosen to minimize multiple scattering; very rapid quenches will be achieved by using pressure changes. Finally, studies of the kinetics of carbon monoxide adsorption on nickel films will be completed and extended to other substrates, and epitaxial films for such studies will be grown.

Research previously supported under DMR 7618962 A01.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0005, THEORETICAL STUDIES OF THE INTERFACE ELECTRONIC PROPERTIES OF TETRAHEDRALLY COORDINATED SEMICONDUCTORS

A. Madhukar, University of Southern California, Electronic Sciences Lab., *3551 University Ave., Los Angeles, California* 90007 (DN775385; N00014-77-C-0397)

As solid-state devices such as field-effect transistors, which are found in naval electronic systems, become more compact and more surface-oriented in their electrical transport behavior, they begin to be dominated by surface- and interface-related effects. This program will seek to find better understanding of the electronic properties of interfaces formed between tetrahedrally coordinated semiconductors and of transport properties of inversion layers formed at a semiconductor-insulator interface.

Green's function techniques are applied to problem areas. In one case theoretical studies are made of the properties of solid-solid interfaces, the Schottky barrier and heterojunction problems. Tight binding Hamiltonians are used to calculate interface states and charge redistribution at interfaces, including the effects of short-range electron-electron interactions. These techniques are now being extended to the case of superlattice structures in various binary III-V compound semiconductor systems. The other area of study is that of the electronic and transport properties of surface inversion layers. The major thrust is to consider both electron-electron and electron-phonon interactions in describing the experimental results of mass enhancement in Shubnikovdehaas and cyclotron resonance measurements.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0006, THEORETICAL STUDY OF SOLITON PHENOMENA IN CONDENSED MATTER

S.E. Trullinger, University of Southern California, School of Letters Arts & Sciences, Dept. of Physics, *3551 University Ave., Los Angeles, California* 90007 (DMR79-08920)

Research previously supported by DMR7708445.

The importance of localized soliton solutions of nonlinear wave equations in condensed matter physics has grown tremendously in the last few years, and soliton phenomena in condensed matter now forms a major and very exciting area of materials research.

Research in the areas of soliton statistical mechanics and response to perturbations will be continued in three exciting new areas as well. These include: (1) a study of the quantum-mechanical behavior of electrically charged solitons (called phi-particles) in charge-density-wave systems, in order to determine whether the phi-particle gas exhibits any instabilities, one possiblity being a superconductive instability, (2) a study of the nonlinear behavior of charge-density-waves in the linear chain conductor niobium-triselenide with emphasis on the role of soliton-like 'discommensurations' in the non-Ohmic conductivity process which has been recently observed and, (3) a study of the phenomenon of self-induced transparency in dense matter in order to establish the conditions for the appearance of new propagating modes (multi-solitons). This phenomenon may provide the basis for an ultrashort-light-pulse generator having importance for laser-induced fusion. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0007, LOWER BOUNDS TO EIGENVALUES IN ATOMIC PHYSICS

R.N. Hill, University of Delaware, School of Arts & Sciences, Dept. of Physics, *Newark, Delaware* 19711 (PHY79-06936)

This research focuses on methods of computing lower bounds to discrete eigenvalues in atomic physics. The primary objectives are (1) proofs of nonexistence for bound states (of negative ions) which do not exist, and (2) computation of tight lower bounds, comparable in accuracy with Rayleigh-Ritz upper bounds, for bound states which do exist. The results, which are expected to include both rigorous proofs and accurate numbers, should be of interest to mathematical physicists who work on the rigorous theory of the Schrodinger equation with coulomb interactions, to atomic physicists and quantum chemists, and to applied mathematicians who work on the general problem of eigenvalue estimation.

A knowledge of the exact number of bound states of specific negative ions is important for scattering theory, and for theories of absorption. For example, the principal process responsible for the opacity of the solar photosphere is the continuous absorption by the H-ion; the predicted absorption coefficient would be modified if H- had an additional bound state below the continuum. Highly accurate calculations of bound state energies of atoms are important when relativistic corrections are being explored, and/or when experimental determination of these energies is difficult or impossible. Moreover, the accuracy of an approximation can only be assessed with certainty if both upper and lower bounds are available. The upper bounds are easily obtained from Rayleigh-Ritz. The lower bounds have, at least in the past, been more difficult to obtain. This project represents an attempt to provide the latter.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0008, ANALYSIS OF TRACE IMPURITIES IN SEMICONDUCTOR MATERIALS

S. Mayo, U.S. Dept. of Commerce, National Bureau of Standards, Electronic Technology Div., *14th & Constitution Ave. N.W., Washington, District of Columbia* 20234 (DN975471; N00014-79-F-0051)

Improvement in electron devices for Navy systems and development of new devices in the future depends on better understanding and control of impurities in semiconductor materials. New, precise techniques to analyze semiconductors for trace impurities, which influence the electronic and optical properties of materials, must be developed to improve material growth and doping programs.

Laser radiation will be used to resonantly excite and ionize atoms in a special ionization chamber in which the electron-ion pairs produced can be detected. This resonance ionization spectroscopic (RIS) technique will be developed and applied to a variety of impurities found in silicon, gallium arsenide, and other semiconductors. High energy laser radiation will impinge on solid samples creating a spallation of atoms from the surface. These atoms will then be subjected to the RIS technique. Parameters must be investigated in order to obtain absolute quantitative measurements of trace impurity concentrations. Subsequently, these methods will be used to profile the impurity concentration as a function of depth into the sample.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0009, PLASMA THEORY

T. Coffey, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980032)

The Linus program at NRL is attempting to apply imploding liner flux compression techniques and advanced plasma source techniques to the generation and confinement of high-energy density plasmas. Such techniques have application to high-pulsed power generation, nuclear fusion and nuclear weapons effects simulation. NRL has developed techniques for stabilized liner implosions in which the liner motion is contractible and reversible. This is in contrast to the more conventional explosively-driven liners. The objective of the present program is to provide the theoretical support needed for the interpretation of experimental results and their extrapolation to larger systems.

This project will utilize advanced techniques in plasma physics and fluid mechanics for modeling the dynamics of imploding liners, liner magnetic field interface and the properties of liner compressed plasmas. The program will be significantly integrated with on-going experimental activities at NRL.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0010, GENERATION AND DETECTION OF MICROWAVE PHONONS

H.N. Spector, Illinois Inst. of Technology, Lewis College of Sciences & Letters, Dept. of Physics, *3300 S. Federal St., Chicago, Illinois* 60616 (DMR76-24466 A02)

Investigation of the generation and detection of microwave phonons in semiconductors, previously supported by NSF Grant DMR 7624466, will be continued. The work involves the theoretical investigation of such as the enhancement of the generation of phonon echoes in semiconductors in the presence of d.c. electric and magnetic fields, the enhancement of up-conversion effects in the microwave frequency region, and the detection of microwave phonons by the mixing of two phonon beams to generate a microwave electric field. In addition, the acoustoelectric interactions due to both deformation potential and piezoelectric coupling, in a frequency range which has not been readily accessible, will be investigated.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0011, SHALLOW DONOR IMPURITIES IN HIGH PURITY SEMICONDUCTORS

G.E. Stillman, University of Illinois, Urbana Champaign Campus, Graduate School, *Urbana, Illinois* 61801 (DN880264; TBD)

Microwave and millimeter wave devices and systems are needed for Navy and DOD applications. The active semiconductor materials used or contemplated being used in many of these devices include the III-V semiconductors, gallium arsenide and indium phosphide. In order to fully understand these materials the amount and type of native impurities must be determined.

The total donor and acceptor levels in gallium arsenide shall be determined by conventional means such as Hall measurements and photoluminescence. High resolution for infrared Fourier transform spectroscopy will be used for determination of shallow donor spectra. Comparison of various crystal growth and epitaxial techniques will be made to determine residual donor levels and their dependence on processing techniques and parameters.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval
Research Lab.

8.0012, VIBRATIONAL RELAXATION OF EXCITED SPECIES OF INTEREST TO CHEMICAL LASERS

L.H. Sentman, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aeronautical & Astronautical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801

A classical model for the interaction of two rotating, dissimilar diatomic molecules under the action of a Morse potential has been developed. Relaxation times for V-R, T and V-V, R energy transfer have been calculated and compared with experimental data over the temperature range 250-5000 degrees K. Good agreement between experiment and theory is obtained for the V-R, T self-relaxation of H(D)F, H(D)Cl, HBr and H(D)I and for the V-V, R relaxation of HF-N2. It is shown that the attractive forces are important only in the self-relaxation of H(D)F, and that the dominant energy transfer mechanism in the self-relaxation of H(D)Cl, HBr and H(D)I, inter-molecular energy transfer is the dominant mechanism.

SUPPORTED BY University of Illinois

8.0013, RESONANCE IONIZATION SPECTROSCOPY OF ATOMS

M.H. Mayfeh, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (PHY78-25247)

This project in atomic physics will exploit the recently developed techniques of resonance ionization spectroscopy, in which a particular species of atom is selectively ionized by absorption of several photons of light of well-defined frequency from a laser. Only a small number of atoms is necessary for successful detection. Particular experiments will include the study of optical and radiative collisions and photoionization cross-sections of short-lived excited states.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0014, KINETICS OF PHASE TRANSITIONS

H. Sato, Purdue University, School of Materials Engineering, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (DMR79-03932)

Research previously supported by DMR7621497.

Theoretical research of irreversible phenomena in crystalline solids, aimed at elucidating nonlinear processes which occur in states far from equilibrium, will be carried out. The method to be used is the Path Probability method of irreversible statistical mechanics, and the phenomena to be studied are those of specific interest in materials science such as the kinetics of order-disorder transformations, the nature of glass transitions and fast ionic transport in solid electrolytes. Through the study of the above problems, the foundations of kinetic processes will be reexamined. Based on the progress made concerning the general description of kinetic processes which occur in systems undergoing phase transitions of second order, basic processes involved in the phase transitions of first order, such as nucleation processes, crystal growth and the necessary theoretical tools for these processes, will be examined.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0015, VARIATIONAL PRINCIPLES FOR SOME PROBLEMS IN ATOMIC PHYSICS

A.R. Rau, Louisiana State University, Agricultural & Mechanical College, School of Arts & Sciences, Dept. of Physics, *University Station, Baton Rouge, Louisiana* 70803 (PHY76-05721 A01)

Research on atomic theory initiated under NSF grant PHY76-05721 will be continued and expanded. Amongst the topics to be considered will be: (A) Variational Principles for Mathematical-Physics Problems, 1) General construction of variational principles, 2) Variational principles for electron degradation in a medium, 3) Variational principles for hierarchical equations (BBG KY and Born-Green-Yvon) arising in statistical physics; (B) Effects of External Fields on Rydberg States, 1) WKB calculations of helium-layer system, 2)Atoms in external fields.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0016, BAND THEORY OF FERROMAGNETIC METALS

J. Callaway, Louisiana State University, Agricultural & Mechanical College, School of Chemistry & Physics, Dept. of Physics & Astronomy, *University Station, Baton Rouge, Louisiana* 70803 (DMR78-17806)

Research previously supported by DMR7619850. Theoretical research on the electronic structure of itinerant ferromagnets will be carried out. In particular, the recently developed methods of energy band theory will be applied to understand various magnetic and transport properties of metals such as nickel and cobalt. Of primary interest will be the calculation of the spin wave excitation spectrum and the dynamic magnetic susceptibility in these materials. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0017, NEUTRON SCATTERING IN MAGNETIC MATERIALS

J.W. Lynn, University of Maryland, College Park Campus, School of Engineering, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (DMR79-00908)

Neutron scattering experiments will be carried out to examine phase transitions in a number of magnetic materials. Special attention will be given to materials which exhibit the coexistence of magnetism and superconductivity, to the spin-flop transition and bicritical point in uniaxial antiferromagnets and to the spin-fluctuation spectra of isotropic ferromagnets just below the Curie temperature. This is a renewal of DMR 7681185. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0018, STRUCTURE OF GRAIN BOUNDARIES

R.W. Balluffi, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR7812804)

This is a basic investigation of the detailed atomic structure of grain boundaries. The atomic configuration in bi-crystals of gold will be modelled by computer simulation. The experimental work will be done by S. Sass of Cornell University. The research to be undertaken will include: (1) determination of the grain boundary core structure: the atomic structure of the core of a range of boundaries of different angles will be calculated by computer simulation; the x-ray structure factors will then be calculated and compared with measurements of the diffraction from boundaries of these same types performed by Sass at Cornell; (2) determination of the core structure of grain boundary dislocations (GBDs) of different angles: the structure of the core of GBDs in a range of boundaries will be calculated; the electron diffraction contrast produced by the GBDs will be calculated and compared with the experimentally observed contrast from GBDs of the same type; and (3) determination of the anisotropy of the boundary energy and the occurrence of faceting: systematic observations of the faceting of a series of predetermined boundaries will be made; computer calculations of the corresponding boundary structures and energies will then be made, and predictions of faceting will be made and compared with experiment. The initial calculation can be extended to grain boundaries in other materials, both pure elements and alloys. It is expected that the results of this research will enhance significantly our understanding of the nature of grain boundaries. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0019, MONOLAYER FILMS ADSORBED ON HIGHLY UNIFORM, WELL-ALIGNED GRAPHITE SUBSTRATES

M. Bretz, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Physics, *Ann Arbor, Michigan* 48104 (DMR79-03614)

This research is a continuation and extension of work supported under Grant No. DMR-7620369. Monolayer helium and hydrogen films adsorbed on highly uniform and well-aligned graphite substrates will be studied with emphasis on two-dimensional superfluid onset phenomena. A newly perfected ac calorimetric technique will be used to measure the heat capacity of sub-monolayer films of helium and hydrogen adsorbed on different substrates. The increased sensitivity of this technique will permit the obtaining of definitive data for layers as thin as 0.25 monolayers. Present facilities are being upgraded to include a pulsed NMR system for the study of ultra-thin films of helium-4.

This is first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0020, MAGNETIC INVESTIGATION OF SOME NEW QUASI TWO-DIMENSIONAL MAGNETIC SYSTEMS

J.E. Drumheller, Montana State University, School of Letters & Sciences, Dept. of Physics, *Bozeman, Montana* 59715 (DMR79-05588)

Lower-dimensional magnetic systems will be studied using a variety of physical techniques such as paramagnetic resonance, optical and infrared spectroscopy, and electric conductivity. Two important but often neglected features of these systems will be investigated–structural phase transitions and the role of antisymmetric exchange in the magnetic properties. Experiments using Raman scattering and high resolution magnetic susceptibility will be carried out to examine the complete exchange interaction including the antisymmetric term. New lower-dimensional magnetic systems will be studied in which mixing of two magnetic ions can occur.

This research was previously supported under DMR 7682089.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0021, REGIONAL INSTRUMENTATION FACILITY FOR A SURFACE SCIENCE AND SUBMICRON ANALYSIS LABORATORY

G.J. Lapeyre, Montana State University, School of Letters & Sciences, Dept. of Physics, *Bozeman, Montana* 59715 (CHE79-16134)

A regional instrumentation facility for surface science and submicron analysis will be established at Montana State University. It will include capabilities for x-ray and ultraviolet photoelectron spectroscopy and scanning Auger microprobe and many ancillary measurements. This facility will serve the instrumentation needs in a diverse number of disciplines including materials science, earth sciences, microbiology, mineralogy, engineering, and physics. Research to be conducted at the facility includes: 1) Angular resolved photoemission studies of clean and chemisorbed surfaces; 2) Surface density of states for normal photoemission; 3) Corrosion effects in molten carbonate systems; 4) Segregation of trace impurity elements in grain boundaries; 5) Characterization of insulating and semiconducting thin films. It will bring an important resource to a diverse group of academic, industrial, and governmental laboratories. This facility will serve the northwestern region of the United States. Independent and collaborative research will be an important thrust of the facility in addition to providing a state-of-the-art measurement capability for concerned scientists.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Chemistry

8.0022, NMR STUDIES OF PHASE TRANSITIONS IN RARE GAS SUBMONOLAYERS

H.Y. Carr, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Physics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DMR7823956)

Nuclear magnetic resonance (NMR) experiments will be carried out to observe density and temperature-dependent local magnetic fields in the gas-like and solid-like phases of rare gas sub-monolayers. In particular, the 2-dimensional 'liquid-vapor' and 'liquid-solid' phase transitions will be studied in these systems by observing the local-field discontinuities between phases. The rare gas will be adsorbed on graphite substrates. Other substrates will be investigated.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0023, APPROXIMATION METHODS FOR ORBIT CALCULATIONS OF SLOWLY MOVING SYSTEMS IN GENERAL RELATIVITY WITH APPLICATION TO BINARY PULSAR PSR 1913 PLUS 16

J.L. Anderson, Stevens Inst. of Technology, School of Engineering, Dept. of Physics & Engineering Physics, *Castle Point Station, Hoboken, New Jersey* 07030 (PHY79-11664)

Research in theoretical gravitational physics initiated under NSF grant PHY77-11687A01 will be continued. Research will concentrate on the application of modern singular mathematical perturbation methods to derive the equations of motion for gravitationally bound radiating systems, such as the binary pulsar. Appropriate boundary conditions for the system will also be developed.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0024, ULTRAFAST ELECTRONIC RELAXATION OF HIGHLY PHOTO-EXCITED MATERIALS

H. Mahr, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Physics, *Ithaca, New York* 14850 (DMR78-16751)

Ultrafast relaxation of excess electron and hole populations will be studied in direct gap semiconductors and other materials. The evolution of electron and hole relaxation will be monitored on a picosecond time scale by measuring time-resolved spectra of luminescence emitted by the sample, using a unique picosecond time-resolution luminescence spectrometer based on c.w. mode-locked, turnable dye lasers. In particular, the following will be studied: (1) the properties and time-history of an electrode-hole-droplet phase in CdSe/CdS crystals at helium temperatures, (2) the relaxation of an electron-hole plasma and its transition in time to an insulating excitonic phase (Mott transition) in CdSe and CdSe/CdS crystals at higher temperatures than helium, and (3) other electron-hole-droplet phases of unusually high critical temperatures and in materials quite different from the typical II-VI semiconductors CdS and CdSe.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0025, A THEORETICAL INVESTIGATION OF ATOMIC SCATTERING PROCESSES

L. Spruch, New York University, Washington Square & University College of Arts & Sciences, Dept. of Physics, *421 1st Ave., New York, New York* 10012 (PHY79-10413)

Research in theoretical atomic physics initiated under NSF grant PHY77-10131 will be continued. Among the topics to be investigated are: 1. Effect of target ionization on electron-atom scattering in a radiation field; 2. Electron-ion scattering in a radiation field; 3. Generalization of the low-frequency approximation for scattering in a laser field; 4. Variational principle for the scattering length for target ground state wave function imprecisely known; 5. Analytic form for the generalized oscillator strength; 6. Lamb shift for an electron image bound by a conducting wall; 7. Charge transfer at high but not asymptotically high impact velocities; 8. Variational principle for charge transfer for target ground state wave function imprecisely known; 9. Extreme principle estimation of transition rates for the emission of photons by low Z excited atoms in intense magnetic fields; 10. Electric dipole polarizability of the neutron.

This is the first year of a four-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0026, PHYSICAL PROPERTIES OF NARROW SUPERCONDUCTING FILMS AND ARRAYS

Y. Kao, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Physics, *Stony Brook, New York* 11790 (DMR77-04511 A02)

This research is a continuation of work begun under NSF grant No. DMR73-07494. The properties of superconducting microbridges, Josephson junctions and arrays of Josephson junctions will be studied in order to develop sensitive radiation detectors. Computer-controlled electron-beam lithography will be used to fabricate superconducting microbridges which range in size from a few thousand angstroms to a few microns. The physical properties of individual bridges will be studied and a special emphasis will be placed on the coupling between adjacent bridges. Measurements will be made to study non-equilibrium effects and the dynamics of superconducting pairs in arrays of Josephson junctions. A primary goal of the research is to understand the coherent properties of arrays of weakly coupled superconductors.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0027, COHERENCE EFFECTS IN QUANTUM OPTICS

L. Mandel, University of Rochester, School of Arts & Sciences, Dept. of Physics & Astronomy, *260 Crittenden Blvd., Rochester, New York* 14627 (PHY79-06349)

This is a proposal for support of research on various interactions between light and atomic systems, in which coherence and cooperative effects play a significant role. These interactions may involve both multiphoton and multiatom processes, and they have become especially accessible to investigation with the development of tunable lasers.

Research will continue on coherence effects in quantum optics. This includes: resonance fluorescence, in which the photon statistics of atomic emission will be investigated; resonant radiation pressure effects on atoms; and laser phase transitions, particularly those in which a first order phase transition of the electromagnetic field can be achieved.

This research is a continuation of that previously supported under NSF grant PHY77-07108A01.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0028, SINGLE ATOM INTERACTIONS AND SURFACE SEGREGATION OF DILUTE ALLOYS USING ATOM-PROBE AND FIELD ION MICROSCOPY

T.T. Tsong, Pennsylvania State University, University Park Campus, School of Science, Dept. of Physics, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (DMR79-04862)

The unique atomic resolution of the field ion microscope (FIM) will be used to investigate systematically the interaction between two atoms, both adatom-adatom and adatom-substitutional atom interactions, on group VIII and IB surfaces. The atomic interaction will be correlated with the electronic structures of adatoms and substrate surfaces, and the directional walk of single atoms under a controllable driving force will also be investigated. This information is not only of fundamental interest, but is also related to the surface reactivity. Since the unique catalytic activity of a surface arises partly from surface segregation of minority species in the alloy, the absolute composition depth profiles of near surface layers of dilute alloys will also be measured using the single atomic layer spatial resolution of the Time-of-Flight Atom-Probe FIM. The dependence of the composition of near surface layers on the bulk concentration of minority species, the sample temperature, and the crystal planes will be investigated, as well as the kinetics of reaching thermodynamic equilibrium. The alloys chosen for this study are nickel-copper, platinum-gold and platinum-copper since they are accessible to FIM study and they also offer various tests of the existing theories.

This research was previously supported by DMR 7815925.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0029, THEORETICAL STUDIES OF RESONANT SCATTERING IN ATOMIC PHYSICS

J.N. Bardsley, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (PHY79-00957)

Research in theoretical atomic physics initiated under NSF grant PHY76-21456 will be continued. The major emphasis of this research will be on the study of dissociative recombination of electrons with molecular ions. Further calculations on electron scattering by neutral molecules and theoretical analysis of the complex coordinate method are proposed.

This is a new year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0030, ATOMIC PROCESSES IN STRONG ELECTROMAGNETIC FIELDS

J.E. Bayfield, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (PHY79-09031)

The physics of atoms and molecules in strong electromagnetic fields is to be broadly investigated using new, sensitive and flexible techniques based upon highly excited atom and negative ion beams in microwave and infrared laser fields. Particular experiments will include: studies of non-resonant multiphoton transitions to a continuum; studies of resonant multiphoton dissociation of high vibrational states of small molecules; studies of resonant multiphoton ionization of highly excited atoms; and merged atoms-beams experiments on strong-field radiative proton-hydrogen collisions.

This is the first year of a three-year continuing grant.

This research is a continuation of that previously supported under NSF grant PHY76-84186A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0031, THEORY OF QUANTUM ELECTRODYNAMIC PROCESSES IN THE FIELD OF AN ATOM

R.H. Pratt, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics, 4200 *5th Ave., Pittsburgh, Pennsylvania* 15260 (PHY78-26491)

Research in theoretical atomic physics initiated under NSF grant PHY7403531A04 will continue. Investigations will emphasize the study of quantum electrodynamic processes in the field of atoms and atomic ions. This includes both the study of specific radiative processes, or processes which combine quantum electrodynamic interactions with nuclear or weak interactions, and general techniques of calculation. Work will continue on bremsstrahlung and pair production (particularly how to compactly characterize data), atomic photo-effect (behavior of dominant radial matrix elements), Rayleigh and Compton scattering, internal conversion and other nuclear transformations. Other studies include atomic environments, an analytic perturbation theory for screened potentals and approximate high-energy wave functions.

1st year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0032, ELECTRONIC PROPERTIES OF LIQUIDS

L.R. Painter, University of Tennessee, Knoxville Campus, School of Liberal Arts, Dept. of Physics, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (006484)

Techniques have been developed for measuring the electronic structure of condensed materials. This technique consists of measuring the reflectances from the surfaces of solids in the visible and ultraviolet spectral region as a function of the angle of incidence of the light. Such data are analyzed to yield the real and imaginary parts of the dielectric constants, epsilon(1) and epsilon(2), and the energy loss function, -im(1/epsilon). The possibility of utilizing such a technique in the study of the electronic properties of liquids was examined first by the contractor during the years 1966 to 1968 wherein she was able to determine the dielectric response of pure water in the region from 2000 to 1050 Angstroms. Under the present contract a new open-dish windowless reflectometer with movable monochromator was constructed in order to extend the studies on liquid water to shorter wavelength (high energy). Reflectance measurements on water with the new cell have been taken in the spectral region from 1350 to 500 Angstroms and the data analyzed to yield the optical and dielectric constants of the liquid. Similar techniques have been used in the study of two silicon diffusion pump oils, Dow Corning 704 and 705 (tetramethyltetraphenytrisiloxane and trimethylpentaphenytrisiloxane, respectively), two linear hydrocarbons, tetradecane and heptadecane, on glycerol, bovine albumin, and DNA. Similar studies have been made on solutions of fucose, cholesterol and the phospholipid lecithin.

SUPPORTED BY U.S. Dept. of Energy, Office of Health &
Environmental Research

8.0033, IONOSPHERIC MODIFICATION EXPERIMENTS AT ARECIBO

W.E. Gordon, Rice University, School of Engineering, Dept. of Electrical Engineering, *6100 Main St., Houston, Texas* 77001 (ATM79-09088)

The ionospheric modification experiments performed at Arecibo have led to significant developments in aeronomy, ionospheric physics and plasma physics. The variety of unexpected phenomena associated with the modification process has stimulated a great deal of theoretical work, especially in the field of nonlinear plasma physics. Of particular importance have been the so-called parametric instabilities which have applications to laser fusion research, and the thermal coupling processes which lead to a striated ionospheric plasma.

Using support provided here Dr. Gordon will mount one major and two follow-up ionospheric modification experiments per year using the current facilities at Arecibo Observatory along with the auxiliary HF facility now under construction and a portable 50 MHz radar positioned on the island of Guadeloupe.

The problems of interest reflect the widening scope of the experimental capabilities at Arecibo. The following areas of research will be studied: 1. Parametric instabilities in the F region, their excitation and suppression. 2. The generation of meter scale field-aligned plasma striations and their relation to plasma instabilities. 3. The interaction of the HF wave with blanketing sporadic E and the implications of these observations on the nature of sporadic E.

The overall aim is to stimulate the ionosphere in order to further our understanding of plasma instabilities.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

8.0034, CHEMIIONIZATION IN COLLISIONS INVOLVING EXCITED RARE GAS ATOMS

R.F. Stebbings, Rice University, School of Natural Sciences, Dept. of Space Physics & Astronomy/Physics, *6100 Main, Houston, Texas* 77001 (C-552)

Absolute rate constants for the ionization of highly excited xenon atoms Xe(nf), with 25 less than or equal to n less than or equal to 41, in collisions with CH3I, C7F14, C6F6 and CH3Br have been measured and the major charged reaction products have been identified for all but CH3Br. Theoretical models view such collisions as being dominated by the interaction between the target molecules and the 'essentially free' Rydberg electrons, and in the case of CH3I, C7F14 and C6F6 the resulting negative ions are indeed similar to those resulting from the attachment of free thermal electrons.

In collisions with NH3 molecules it is observed that the xenon Rydberg atoms are selectively excited to discrete, more highly excited states. These states are identified by the technique of field ionization and are found to be displaced in energy from the initial Rydberg states by amounts equal to the rotational spacings of the NH3 molecule.

The collisions may thus be represented by Xe(nf) plus NH3(J) yields Xe(n'l') plus N3H(J-1) and demonstrate, for the first time, the conversion of rotational to electronic excitation energy in collisions.

SUPPORTED BY Robert A. Welch Foundation

8.0035, SPACETIME PHYSICS

J.A. Wheeler, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (PHY78-26592)

A program of theoretical research in gravitational physics will be initiated. Topics to be investigated include: (1) Quantum gravity; (2) Early universe cosmology; (3) Gravitational collapse; (4) Quantum field theory in curved spacetime.

This is the 1st year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0036, THEORETICAL STUDIES IN MANY-BODY PHYSICS

B. Sutherland, Utah Higher Education System, University of Utah, School of Letters & Science, Dept. of Physics, 1400 E. *2nd S., Salt Lake City, Utah* 84112 (DMR77-08474 A01)

Research previously supported by DMR7708474.

Theoretical research in many-body physics will be carried out. This will concentrate on non-perturbative techniques on model systems which are relevant to the understanding of quantum fluids, phase transitions, non-linear fields and non-equilibrium phenomena. Three areas of theory will be explored: a) soliton physics; b) energy band theory and c) two-dimensional magnetic systems, described by a Heisenberg Hamiltonian.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0037, THERMODYNAMICS AND THERMOELECTRICITY IN RUTILE AND RELATED SYSTEMS

O.W. Johnson, Utah Higher Education System, University of Utah, School of Science, Dept. of Physics, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DMR79-07802)

The transition metal oxides and related compounds are important due to their high melting temperatures and thermodynamic stability. Quantitative understanding of the properties and behavior of these materials, unfortunately, has lagged far behind that of other materials such as covalent semiconductors or metals. The rutile phase of titanium dioxide is probably the best understood of the transition metal oxides, although much of what has been learned is still rather qualitative. Rutile is, thus, a logical choice as a model system in which to study the characteristic properties of this class of materials. There are also potential technological applications for rutile.

This project is concerned with the thermodynamic parameters necessary to characterize completely lattice defects (oxygen vacancies and titanium interstitials, hydrogen interstitials, and substitutional impurities) in the rutile form of titanium dioxide. This is done by measuring conduction electron concentration at high temperatures in a known ambient controlled by a zirconi electrolytic cell. Thermoelectricity in rutile and similar systems also is investigated with the goals, first, of using the thermoelectric behavior as a probe of other transport properties and, second, of improving the figure of merit of thermoelectric devices. Previous work on this project has contributed, in part, to the development of an electrically conducting rutile ceramic of improved chemical stability.

First year of a two-year continuing grant; renewal of work supported by DMR76-82077.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0038, IONOSPHERIC WAVE-PARTICLE EFFECTS

D. Strickland, Science Applications Inc., *8400 Westpark Dr., McLean, Virginia* 22101 (DN980217; N00014-79-C-0197)

To investigate the effects of ionospheric plasma wave-particle interactions on the transport of non-thermal electrons.

Develop plasma physics modules which treat wave-particle interactions and incorporate these modules into NRL's existing numerical code of electron transport and deposition in the ionosphere.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval
Research Lab.

8.0039, ROLE OF DISLOCATIONS IN DYNAMIC FAILURE OF LIF UNDER SHOCK CONDITIONS

G.E. Duvall, Washington State University, School of Arts & Sciences, Dept. of Physics, *Administration Bldg., Room 101, Pullman, Washington* 99163 (DMR79-06122)

The mechanisms of precursor decay in doped and undoped LiF will be studied by propagation of shocks in 100 directions wherein primary (110) slip systems are stressed. In the 100 experiments Mg will be diffused into undoped LiF and the resulting layer hardened by suitable annealing. For 28 kilobar impact, precursor amplitudes will be measured as a function of distance from the boundary between Mg-hardened and undoped LiF. The results will suggest whether or not dislocations are being driven at supersonic velocities in pure LiF and whether or not dislocation break-up is occurring at the high velocities produced by the shock wave.

This research was previously supported under DMR 7708656.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0040, OPTICAL DETECTION OF ELECTRON SPIN RESONANCE IN COMPOUND SEMICONDUCTORS

B. Henderson, University of Dublin Trinity College, Physical Lab., *Dublin, Ireland* (DA0E9302; DAERO 79 G0028)

Develop techniques and study luminescense and recombination of free and bound electrons, holes, and excitons in III-V and II-VI semiconductor compounds and alloys.

Optical detection of magnetic resonance and spin-dependent photoconductivity of semiconducting solids will be investigated. Both techniques make use of spin-dependent effects for observation of photo-excited phenomena in semiconductors.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel
Development & Readiness Command,
Research & Standardization Group

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, INTERSTELLAR MEDIUM STUDIES

B.L. Lutz, Lowell Observatory, *P.O. Box 1269, Flagstaff, Arizona* 86001 (AST7820131)

High-resolution studies of the visible and near-infrared spectra of moderately to heavily reddened early-type stars are proposed as a continuation and extension of a study of interstellar diatomic carbon (C2). The interstellar line spectrum of stars in the dense Cygnus OB2 (VI Cyg) association will be studied as an optical map of the spatial distribution of the consistent atomic and molecular species within the cloud. The studies will be combined with spatial mapping in carbon monoxide 12CO and 13CO radio lines. This cloud, which allows the combination of optical and radio observations, is thought to be a transition between the classical tenuous and dark clouds and represents a rare opportunity to study the interstellar chemistry of a dense optical cloud. Cloud models for this region will be investigated.

Additional observations of Ophiuchi are proposed to determine the kinetic temperature of the cloud through the observation of interstellar C2. Specifically, the 2-O R (O) line will be sought using the PEPSIOS for combination with the Q(2) line observed last season. A similar search for interstellar C2 in the zeta Persei spectrum is also proposed. Both sets of observations are seen as tests of current cosmochemical models of tenuous cloud regions.

Other stars such as HD183143 and BD-plus 66 degrees 1675 are included in the interstellar medium study, and new possible molecules detectable in the infrared are added to the program search list.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0002, EVALUATION OF MULTIPLE-MIRROR TELESCOPE ACTIVE OPTICS ALIGNMENT CONTROL SYSTEM

W.F. Hoffmann, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (AST76-20822 A02)

A multiple-mirror telescope on Mount Hopkins, a 8,650 foot mountain south of Tucson, Arizona, is in the final stages of construction. It has been funded by the University of Arizona and the Smithsonian Astrophysical Observatory. It is equivalent to a conventional telescope 4.5 meters in diameter but uses six 1.8 meter diameter mirrors working together. The crucial element is the active optics control system which combines the beams from all six mirrors, continually adjusting each one to maintain optimum alignment.

A three-year program of testing and evaluation of the active optics system will be carried out at the University of Arizona. The performance of the optical system will be critically evaluated. The system will be improved wherever possible. The limiting factors in the telescope mechanics and in the earth's atmosphere will be identified. The results will be analyzed with respect to the application of the multi-mirror approach for the construction of new very large aperture optical and infrared telescopes.

This is a continuation of research previously funded under NSF Grant AST 76-20822.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0003, MODERN AND HISTORICAL ANALYSES OF THE SOLAR CONSTANT

R.J. Angione, California State University & Colleges, San Diego State University, School of Sciences, Dept. of Astronomy, *5402 College Ave., San Diego, California* 92115 (ATM77-07987 A01)

This grant will support the continuation of a long-term program of analysis of data on variations in atmospheric constituents and the solar spectral energy output during the period 1902 to 1960, combined with modern ground-based observations.

Half of the effort will be devoted to accurate determination of the solar constant and spectral energy distribution using modern techniques of analysis on published results and archival data from the Smithsonian Institution's Solar Constant Observing Program. This program was operated for more than 50 years under the direction of Dr. C. G. Abbot, and is unparalleled among photometric programs in terms of accuracy and time-length of baseline. Analysis of these data represents a way of recovering accurate, quantitative information on variations in the solar energy output over long-term scales.

The second half of the effort will be devoted to the establishment and operation of a state-of-the-art solar constant observing station at Mt. Laguna Observatory in Southern California. This station will incorporate all of the methods proven useful in over fifty years of Smithsonian observations, as well as modern technical advances to provide highly accurate contemporary benchmark values for variations in atmospheric constituents and the solar constant. Experience gathered in the operation of this station will be used in interpretation of the Smithsonian data. Long-term operation of the station is planned in a manner that will keep the need for long-term support at an absolute minimum.

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Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0004, RESEARCH WITH PHOTON-COUNTING SPECTROMETER SYSTEMS AT THE HALE OBSERVATORIES

S.A. Shectman, Hale Observatories, *813 Santa Barbara ST., Pasadena, California* 91101 (AST79-11332)

The Carnegian spectrograph of the Las Campanas Observatory 2.5-meter duPont telescope has been equipped with a photon-counting, intensifier diode array detector system. A similar system, developed as a prototype, is in use at the Mt. Wilson 2.5-meter telescope and the Palomar 5-meter telescope. These instruments are being used for a wide variety of observational projects.

This grant will provide for technical support of these instruments. There will be development of improved facilities for data reduction. The resolution and dynamic range of this detector will be improved.

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Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0005, THEORETICAL STUDIES OF PLANETARY ATMOSPHERES

G.E. Thomas, University of Colorado, Boulder Campus, Lab. for Atmospheric & Space Physics, *1200 University Ave., Boulder, Colorado* 80302 (ATM76-23812 A02)

This grant funds a study of the radiative processes which determine the thermal structure of the middle atmospheres of the planets, particularly the stratosphere and mesosphere of Earth. The initial emphasis will be on developing general theoretical methods for calculating the time-dependent properties of temperature and density, as they are affected by changing solar ultraviolet heating, or by impulsive or harmonic disturbances due to dynamical processes. Specific applications will be made to the diurnal temperature variation of the middle atmosphere, to the coupling of photochemistry to radiation, and to the effects of non-LTE on the thermal emission. In addition, this grant funds a study of the structure of the outer hydrogen exosphere of Earth and the planets. This will be achieved both by analysis of satellite measurements and through a dynamical theory of the interaction of the exosphere with solar radiation. It is planned to conduct a detailed study of the behavior of atomic hydrogen in the upper thermosphere during a geomagnetic storm, from an analysis of Lyman alpha airglow data and from a dynamical theory of a time-dependent exosphere.

SUPPORTED BY U.S. National Science Foundation,
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of Atmospheric Sciences

10.0006, HOT STARS WITH EXPANDING ATMOSPHERES

D.G. Hummer, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics & Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (AST77-23183)

Support is for studies concerned with the outer atmospheres and stellar winds of very hot and luminous stars, such as those of type Of, nuclei of planetary nebulae and Wolf-Rayet stars. Individual areas of research include stellar wind and line formation theory arising from stellar rotation, stellar wind models for absolute instability to investigate possible heating mechanisms for the wind, and the current discrepancies between theoretical and observational results on the temperature and ionization state of the wind. In the course of these investigations, excitation equilibrium calculations for He II, N III, C III-IV, and O VI will be carried out using a powerful multi-level, spherical geometry, expanding-atmosphere code that has been developed at the University of Colorado.

Prior support was by NSF Grant AST 76-22032.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
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10.0007, SPECTROSCOPIC STUDIES RELATING TO PROBLEMS IN STELLAR EVOLUTION THEORY AND EARLY CHEMICAL EVOLUTION

D. Butler, Yale University, Graduate School, Dept. of Astronomy, *206 Elm, New Haven, Connecticut* 06520 (AST79-10009)

This research will be concerned with the study of a class of very old intrinsic variables known as BL Herculis stars. The stars vary on time scales of one to three days, and exist in globular clusters of the galaxy, in dwarf spheroidal galaxies and in the Small Magellanic Cloud. Very little is known, however, about the BL Herculis stars in the general galactic field. Such stars will be studied via the techniques of intermediate-band photoelectric photometry. Stellar atmospheric parameters such as surface gravity, temperature and chemical composition will be determined for these stars.

There will be studies of the chemical abundances of RR Lyrae stars in the Magellanic Clouds, and there will be a low-resolution spectroscopic study of giant and subgiant stars in the globular clusters NGC6397.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0008, FUNDAMENTAL AND ANALYTICAL INVESTIGATIONS OF MECHANISMS AND PHENOMENA RELATED TO SPACECRAFT ELECTROCHEMICAL DEVICES

W.C. Nottingham, University of the District of Columbia, Graduate School, Dept. of Chemistry, *1025 Vermont Ave. N.W., Mt. Vernon Sq. Campus, Washington, District of Columbia* 20005 (NGR 09-050-003)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0009, NATURE OF SHORT-PERIOD BINARY STARS FROM AN OBSERVATIONAL VIEWPOINT

R.E. Wilson, State University System of Florida, University of South Florida, School of Natural Sciences, Dept. of Astronomy, *4202 Fowler Ave., Tampa, Florida* 33620 (AST77-09188)

Fundamental data will be extracted from existing light curves of contact and other short-period binary stars as a test of theories of the structure and evolution of these binaries and a stimulus to new theoretical ideas. Large numbers of such systems need analysis to permit meaningful statistical studies of their properties. The work will include W UMa-type and other contact binaries, also 'short-period Algol', and 'short-period Beta Lyrae' type systems, so far almost completely neglected except for gathering of observations. This basic ground-work should lead to a better understanding of the nature of these latter type systems from an evolutionary point of view. The light curve and differential corrections programs developed by the investigators will be further improved, and the latest versions made available to workers in the field.

SUPPORTED BY U.S. National Science Foundation,
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of Astronomical Sciences

10.0010, OBSERVATIONS OF INTERSTELLAR LINES IN STARS TOWARD THE NORTH POLAR SPUR

P.C. Frisch, University of Chicago, Graduate School, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (NSG 5405)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0011, RESEARCH IN RADIO ASTRONOMY

G.W. Swenson, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (AST79-01690)

Research using the method of Very Long Baseline Interferometry (VLBI) to observe radio astronomical sources, including fully-automated VLBI station operation, will be carried out. The participation of the Vermillion River Observatory (VRO) in the VLBI network will continue providing a badly-needed midwestern station to the interim network of existing telescopes. It is intended to equip the 120-foot telescope for operation at six centimeters wavelength.

The 18 cm continuum flux monitoring program, which has been under way since 1973, will be continued for about 30 sources which show significant variations at this wavelength plus a score or so more which might be expected to show variations. In addition a systematic monitoring program will be instituted for the 18 cm fluxes ascribable to the small-diameter components of a large number of sources, using VLBI between the VRO telescope and the National Radio Astronomy Observatory 300-foot telescope.

The principal funding is from the University of Illinois, which supports the VRO and most of the salaries of the Principal Investigator and his doctoral-level colleagues. This is a continuation of AST-7700440AO1.

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of Astronomical Sciences

10.0012, RADIO OBSERVATIONS OF INTERSTELLAR CLOUDS, CIRCUMSTELLAR SHELLS, AND COMETS

L.E. Snyder, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Astronomy, *Urbana, Illinois* 61801 (AST79-07830)

The research in this project is concerned with molecules in astronomical objects. Maser emission from silicon oxide (SiO) and hydroxyl radical (OH) molecules originating in shells of material surrounding stars will be studied to learn more about the physics of the maser pumping processes and to measure the sizes of these circumstellar shells. The SiO maser in the Orion region remains enigmatic and this research should cast light on its nature.

Observational searches for certain large molecules, including glycine, will be carried out in various regions of the interstellar medium. The positive detection of glycine, the simplest of the amino acids, will have strong implications for theories of the origins of life on the Earth and elsewhere in the universe. Observations of molecules containing deuterium, the isotope of hydrogen of mass 2, will enhance understanding of interstellar abundance ratios, chemical fractionation, and partial ionization. The observations will also enhance understanding of the fundamental molecular constants. Radio observations of molecules in comets will be made in order to advance the currently limited understanding of cometary chemistry. The ultimate goal of this research is to understand galactic chemical evolution and its role in the various stages of star formation. The observations will be made with three different radio telescopes, the 36 foot and 140 foot of the National Radio Astronomy Observation and the University of Illinois' Vermillion River Observatory's 120 foot dish.

This is a continuation of AST-7701345AO1.

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of Astronomical Sciences

10.0013, STUDY OF BOW SHOCK IONS, PARTICLE ACCELERATIONS AND PLASMA INSTABILITIES

C.S. Wu, University of Maryland, College Park Campus, Inst. for Fluid Dynamics & Applied Mathematics, *College Park, Maryland* 20742 (NSG 5408)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0014, OBSERVATIONS OF DISTANT CLUSTERS AND CENTRAL REGION OF OUR GALAXY

K.A. Janes, Boston University, School of Arts & Sciences, Dept. of Astronomy, *881 Commonwealth Ave., Boston, Massachusetts* 02215 (AST78-25535)

It has not been possible until recently to say, even approximately, how our galaxy was formed or how it has evolved. However, in the past two or three years some rather detailed theoretical descriptions of the formation and evolution of the galaxy have been published, making specific comparisons with observation possible. The dynamics of the galaxy and the general distribution of stars and gas are reasonably well understood and can be compared directly with theory. However, some of the theory makes predictions about the chemical evolution of the galaxy, that is to say the relationship between the chemical compositions of stars and their ages and distribution in the galaxy. We know little about the compositions of stars as a function of age even in the vicinity of the sun and almost nothing about the chemical makeup of stars in distant parts of the Galaxy. The aim of this research project is to study some distant clusters of the galactic disk and to analyze low-resolution spectra of stars in the central region of the galaxy. From these observations it will be possible to learn something about the nature of the stellar population in these distant regions and how the stars there may differ from those in the vicinity of the sun.

SUPPORTED BY U.S. National Science Foundation,
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of Astronomical Sciences

10.0015, STUDY OF THE PROPAGATION OF GEOMAGNETIC PULSATION SIGNALS

W.J. Hughes, Boston University, School of Liberal Arts, Dept. of Astronomy, *755 Commonwealth Ave., Boston, Massachusetts* 02215 (NSG 5407)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

10.0016, FLUID MOTION IN THE EARTH'S CORE AND MANTLE

W.V. Malkus, Massachusetts Inst. of Technology, School of Science, Dept. of Mathematics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (EAR77-12889 A01)

This is a project to explore the consequences of a newly discovered analytical path towards the determination of the non-linear macrodynamics of planetary and solar dynamos. Those general features of dynamo magnetic fields and the concommitant global flows are sought which are insensitive to the details of the energy-supplying small-scale motions. Preferential selection of steady or periodic dipole parity, westward drift of the earth's core fluid, and 'equatorial acceleration' on the sun are all macrodynamic features now accessible to investigation without dependence upon numerical experiment. The new formulation of the macrodynamical dynamos problem is based upon a determination of the Taylor-like constraints on Lorentz forces in the stably-stratified fluid adjacent to the actively generating region. The flows produced in the stably-stratified fluid can be both the finite amplitude signature of the dynamo process and the principal feature determining parity and polarity. Equally important, the axisymmetric form of the initial non-linear problem so formulated is separable and solvable for many different small-scale forcing functions.

SUPPORTED BY U.S. National Science Foundation,
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10.0017, MARS ORBITER AND COMET MISSION

T.B. McCord, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 7638)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Office of Space Science

10.0018, MICROWAVE SPECTROSCOPY

H.E. Radford, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (31R-4R50-01)

Laboratory measurements of microwave and far-infrared spectral lines of interstellar molecules are done by resonance absorption methods.

SUPPORTED BY Smithsonian Institution, Astrophysical
Observatory

10.0019, OPTICAL SPECTROSCOPY OF THE INTERSTELLAR MEDIUM

W.A. Traub, Smithsonian Institution, Astrophysical Observatory, Optical & Infrared Div, *60 Garden St., Cambridge, Massachusetts* 02138 (310-4050-12)

A spectroscopic search was made for a deuterium emission line in the Orion nebula in order to determine the isotope ratio of deuterium to hydrogen, which is a crucial parameter in cosmological models of the formation of the universe. From our observations, we are able to set an upper limit D/H less than 1.3 times 10 to the minus 4th power; from our earlier detection of deuterium on Jupiter, we expect that a factor of 10 further improvement will be needed for a measurement in Orion. The presence of a previously undetected high-velocity cloud with an H alpha emission feature which partially overlaps the expected D alpha position is the only impediment to a more accurate determination.

Analysis of our earlier observations of the CN absorption band 3874 A was completed, resulting in a determination of the cosmic background radiation temperature (at 1.32 mm) of about 2.9 degrees K.

SUPPORTED BY Smithsonian Institution, Astrophysical
Observatory

10.0020, THEORETICAL ASTROPHYSICS - THE PHYSICS OF DENSE STELLAR SYSTEMS

J.G. Hills, Michigan State University, School of Natural Sciences, Dept. of Astronomy & Astrophysics, *243 Natural Resources Bldg., East Lansing, Michigan* 48824 (AST78-21454)

A research program primarily concerned with the dynamics of dense stellar systems (galactic nuclei and the cores of globular clusters) will be carried out. In particular, a quasi-stellar object (OSO or quasar) model in which the tremendous energy produced is provided by the tidal breakup of stars and the subsequent capture of their debris by large black holes in the galactic nuclei will be investigated. There is recent observational evidence that there is a large black hole in one of the large well-known galaxies. Research in the physics of other dense physical systems will also be done.

SUPPORTED BY U.S. National Science Foundation,
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Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0021, STUDY OF THE FLUCTUATIONS IN THE COSMIC X-RAY BACKGROUND

E.L. Turners, Princeton University, Graduate School, Dept. of Astrophysical Sciences, *205 Nassau Hall, Princeton, New Jersey* 08540 (NSG 5415)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
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10.0022, MULTIFREQUENCY OBSERVATIONS OF SELECTED GALAXIES AND EXTRAGALACTIC SOURCES

P.J. Huggins, New York University, Graduate School, *100 Washington Sq. E., New York, New York* 10003 (NSG 5411)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
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10.0023, OBSERVATIONS OF EMISSION-LINE GALAXIES AND QUASARS

D.W. Weedman, Pennsylvania State University, University Park Campus, School of Science, Dept. of Astronomy, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (AST79-01067)

Large numbers of emission-line galaxies have been discovered in surveys during the past decade, primarily by Markarian with the Byurakan (USSR) Schmidt telescope and by various observers with the Tololo (Chile) Schmidt. These galaxies need further study because the source of radiation energizing the gas which produces the emission lines is not understood. In many cases, this source seems related to that in the quasars. Consequently, extensive studies of both emission-line galaxies and quasars are proposed to investigate the energy source. For quasars much study will also be directed toward determining their distribution in the universe. The optical observations will be done with telescopes at the Black Moshannon Observatory of the Pennsylvania State University as well as the national observatories. Quasars will also be studied with the Very Large Array radio telescope.

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10.0024, THE CONSTRUCTION OF NEW ASTROMETRIC INSTRUMENTATIONS FOR THE DETECTION OF EXTRASOLAR PLANETARY SYSTEMS

G.D. Gatewood, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (AST79-09181)

Astrometric instrumentation combining photon counting techniques with those of precision interferometric spacing and minicomputer technology has been designed and built at the Allegheny Observatory. Tests with the Allegheny 76-cm Thaw photographic refractor indicate that the new detector may be expanded into a system capable of rivaling the astrometric precision projected for the Space Telescope and the European Space Agency's HIPPARCOS satellite. Precision is tripled and stars ten times fainter can be reached. These tests show that most of the existing long focus astrometric telescopes could, with careful modeling, obtain precisions of 2 or 3 mas (1 mas equals 1 milliarcsec equals 0.001 arcsec) per object per night. This precision combined with the ability to routinely measure 15th-magnitude and fainter reference stars would give astrometrists the ability to determine precise parallaxes at stellar distances greater than 100 parsecs and to survey nearly 100 neighboring stars for evidence of Jupiter-like planets. The Multichannel Astrometric Photometer (MAP) will be improved and parallax observations will be undertaken.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
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of Astronomical Sciences

10.0025, OBSERVATION OF LUNAR OCCULTATIONS AND OTHER MUTUAL PHENOMENA

D.S. Evans, University of Texas, Austin Campus, School of Arts & Sciences, Dept. of Astronomy, *200 W. 21st, Austin, Texas* 78712 (AST77-12216 A02)

Several telescopes of the McDonald Observatory in west Texas will be used with photoelectric photometers for recording observations of lunar occultations-eclipses of stars by the moon. The fast response time of the photometer as the moon moves past the star has the effect of producing an angular resolution even smaller than the diffraction limit of the telescope ued for direct observation. The position of the moon's edge is determined very accurately for orbital correction, double stars are frequently discovered, whose angular separations are too small for direct observation. In favorable cases stellar diameters can be determined. In the rare events when a star is occulted by a planet or asteroid, information about the planet's atmosphere and size, or the position and size of the asteroid are obtained. For occultations by these solar system objects portable equipment will be taken to the site where the event is predicted to occur. Observations in various wavelength ranges of the spectrum with more than one telescope will increase the astrophysical value of the information obtained.

Prior support was by NSF grant AST 77-12216.

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Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0026, RAPID OPTICAL VARIATIONS FROM COMPACT STARS

R.E. Nather, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST79-06340)

This grant will provide support for observational studies of rapid optical variations of compact stars: white dwarf stars, neutron stars, and black holes. The work will concentrate primarily on the rapid variations associated with white dwarf stars, both the single white dwarfs and those in cataclysmic variables (the novae and related stars). The single white dwarf stars show variations in their luminosity because they are pulsating stars. Studies of these stars will include searching for new variable stars and measuring accurate periods and period changes of the pulsations. There will be studies of the rapid coherent oscillations of the white dwarf stars in the cataclysmic variables. There will be studies of the rapid flickering and quasi-periodic oscillations from the disk of material (accretion disk) surrounding the white dwarf. There will be measurements of the orbital radial velocity curves of these close binary systems, and there will be measurements of the profiles and changes in the profiles of the spectral emission lines coming from the accretion disk.

SUPPORTED BY U.S. National Science Foundation,
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Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0027, IRREGULAR SATELLITES AND CERTAIN UNUSUAL NON-TROJAN ASTEROIDS

R.W. Shorthill, Utah Higher Education System, University of Utah, School of Science, Geospace Sciences Laboratory, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (AST78-24847)

The planned research will help determine the surface mineralogy of the faint irregular satellites of Jupiter and Saturn and selected asteroids, and distinguish among proposed theories of their origin. Progress on both mineralogy and origin is presently hampered by an extreme lack of observational data. The outer Jovian satellites form two groups at different Joviocentric distance parameters. Questions of origin also apply to the irregular Saturnian satellites Hyperion and Phoebe. The measurement of the visible and near-infrared reflectance spectra of solid planetary surfaces is the most useful means of remotely determining their mineralogy and petrology. To determine the mineralogy and petrology of the satellite surface, one needs the maximum spectral coverage and resolution permitted by the available flux. Measurement of asteroidal spectral reflectances at 1.25, 1.6, and 2.2 mu will more than double the spectral range over which asteroids may be compared with laboratory measurements of meteorite samples. Broadband photometry is suitable for the determination of near-infrared asteroid spectral reflectances. Standard broad-band astronomical filters and standard stars will be used, employing large reflecting telescopes. These observations will be made of the irregular satellites and main belt asteroids of unusual color and non-main belt asteroids of unusual orbits.

SUPPORTED BY U.S. National Science Foundation,
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of Astronomical Sciences

10.0028, THE EVOLUTION OF STRUCTURE IN THE UNIVERSE

P.E. Boynton, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (INT78-08774)

This award supports basic research in observational studies of the evolution of the structure of the Universe. The project is conducted by the Department of Astronomy, University of Washington; and the Research Institute for Electromagnetic Waves of the Department of Physics, University of Rome; and takes place under the Cooperative Science Programs jointly sponsored by the National Science Foundation and the Italian National Council for Research.

The project's objective is to test a ground-based program of FAR infrared observations to detect and measure the mass-density fluctuations in the early Universe (Z approximately equal to 1000). The investigators will examine small angular scales (one to three minutes of arc) in the relict radiation by a technique based on state-of-the-art technology. The data are expected to clarify our knowledge about the inhomogeneity of the mass present in the primordial Universe, and thereby elucidate the question of the so-called 'missing mass', the difference between the observable mass in the present Universe and the mass that would have had to be present at the primordial explosion that created the structure of the Universe. The measurements in question would provide a fundamental test for a whole class of theories concerning the evolution of the Universe. Also, the detection of very distant clusters of galaxies may result from the observational program, as well as a better understanding of the characteristics of the earth's atmosphere.

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Programs

10.0029, STUDIES OF DISCRETE ELECTROMAGNETIC EMISSIONS IN THE MAGNETOSPHERE

C.S. Lin, University of Washington, School of Arts & Sciences, Dept. of Geophysics, *Seattle, Washington* 98105 (NSG 5410)

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Jan. 1980 100 p
(NASA-SP-7037(117)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 307 reports, articles, and other documents introduced into the NASA scientific and technical information system in December 1979. Author

N80-17022# Naval Air Engineering Center, Lakehurst, N.J. Engineering Dept.
COMPILATION OF DATA COVERING AIRCRAFT SERVICING FACILITIES ABOARD AVIATION AND AMPHIBIOUS AVIATION SHIPS
Michael A. Strano 17 Oct. 1979 279 p
(AD-A076443; NAEC-ENG-6703-Rev-15) Avail: NTIS HC A13/MF A01 CSCL 01/3

This report is a compilation of data covering aircraft servicing facilities aboard aviation and amphibious aviation ships. Data is furnished on aircraft servicing facilities relating to fueling and defueling, electrical starting and servicing, oxygen and nitrogen, aircraft inertial alignment, compressed air, and cooling and starting air. GRA

N80-17023# Air Force Academy, Colo.
AIR FORCE ACADEMY AERONAUTICS DIGEST, SPRING 1979 Final Report
E. J. Jumper and M. M. Tower Jul. 1979 167 p
(AD-A075419; USAFA-TR-79-7) Avail: NTIS HC A08/MF A01 CSCL 20/4

This digest covers unclassified research in aeronautics performed at the United States Air Force Academy during the six months ending 1 July 1979. This report includes individual technical papers in the specific areas of aerodynamics, fluid mechanics, experimental instrumentation, engineering education and thermodynamics and heat transfer. GRA

N80-17024# Accademia Nazionale dei Lincei, Rome (Italy).
COLLECTED WORKS OF A. G. CROCCO. VOLUME 1: 1904 TO 1925 [A. G. CROCCO. OPERE. PUBBLICATE A CURA DELL'ACCADEMIA NAZIONALE DEI LINCEI]
Arturo Gaetano Crocco 1978 592 p refs In ITALIAN
Avail: NTIS HC A25/MF A01

A collection of 80 papers published by A. G. Crocco up to 1925 is presented. The subjects refer to the general field of aeronautics and aerodynamics, including papers on dirigibles, helicopters, aircraft construction materials, navigation, aerodynamics, aircraft artillery, the use of helium in airships, economic factors, and flight stability. Author (ESA)

N80-17025# Accademia Nazionale dei Lincei, Rome (Italy).
COLLECTED WORKS OF A. G. CROCCO. VOLUME 2: 1926-1940 [A. G. CROCCO. OPERE. PUBBLICATE A CURA DELL'ACCADEMIA NAZIONALE DEI LINCEI]
Arturo Gaetano Crocco 1978 591 p refs In ITALIAN
Avail: NTIS HC A25/MF A01

A collection of 57 papers published by A. G. Crocco from 1926 to 1940 is presented. The subjects refer to the general fields of aeronautics and aerodynamics, including papers on military aviation, aerodynamic stability, aerodynamic characteristics, stratospheric flight, flight conditions, aircraft instruments, and economic and political issues. Author (ESA)

N80-17026# Accademia Nazionale dei Lincei, Rome (Italy).
COLLECTED WORKS OF A. G. CROCCO. VOLUME 3: 1941 TO 1962 [A. G. CROCCO. OPERE. PUBBLICATE A CURA DELL'ACCADEMIA NAZIONALE DEI LINCEI]
Arturo Gaetano Crocco 1978 526 p refs In ITALIAN
Avail: NTIS HC A23/MF A01

A collection of 46 papers published by A. G. Crocco from 1941 to 1962 is presented. The subjects refer to the general fields of aeronautics and aerodynamics, including papers on military aviation, aerodynamic stability, aerodynamic characteristics, interplanetary navigation, atomic propulsion, missiles, and astronautics. Author (ESA)

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N80-17027 Stanford Univ., Calif.
VISCOUS-INVISCID INTERACTIONS IN LAMINAR FLOWS NEAR SEPARATION REGIONS AND CORNERS Ph.D. Thesis
Jose Carlos Albano do Amarante 1979 142 p
Avail: Univ. Microfilms Order No. 8001872

The implications of the viscous inviscid interactions close to a separated region resulting in regular integration of the two dimensional boundary layer equations are discussed. An inverse boundary layer method is developed where the interactions are represented by prescribing a displacement thickness profile. It is based on a vorticity-stream function formulation with similarity variables which are very convenient since the required transition from a standard approach to an inverse approach is made smoothly and without difficulties. The method is then applied to study an axially symmetric three dimensional separation. Dissert. Abstr.

N80-17028*# Nielsen Engineering and Research, Inc., Mountain View, Calif.
A SUPERSONIC THREE-DIMENSIONAL CODE FOR FLOW OVER BLUNT BODIES: PROGRAM DOCUMENTATION AND TEST CASES Progress Report, 1 Mar. 1978 - 30 Apr. 1979
D. S. Chaussee and O. J. McMillan Feb. 1980 205 p

(Contract NAS1-15305)
(NASA-CR-3224; NEAR-TR-194) Avail: NTIS
HC A10/MF A01 CSCL 01A

The use of a computer code for the calculation of steady, supersonic, three dimensional, inviscid flow over blunt bodies is illustrated. Input and output are given and explained for two cases: a pointed code of 20 deg half angle at 15 deg angle of attack in a free stream with M sub infinite = 7, and a cone-ogive-cylinder at 10 deg angle of attack with M sub infinite = 2.86. A source listing of the computer code is provided. Author

N80-17029*# Neilsen Engineering and Research, Inc., Mountain View, Calif.
CALCULATION OF TWO-DIMENSIONAL INLET FLOW FIELDS IN A SUPERSONIC FREE STREAM: PROGRAM DOCUMENTATION AND TEST CASES Final Report, 1 Mar. 1978 - 30 Apr. 1979
S. H. Biringen and O. J. McMillan Mar. 1980 165 p refs
(Contract NAS1-15305)
(NASA-CR-3221; NEAR-TR-195) Avail: NTIS
HC A08/MF A01 CSCL 01A

The use of a computer code for the calculation of two dimensional inlet flow fields in a supersonic free stream and a nonorthogonal mesh-generation code are illustrated by specific examples. Input, output, and program operation and use are given and explained for the case of supercritical inlet operation at a subdesign Mach number (M Mach free stream = 2.09) for an isentropic-compression, drooped-cowl inlet. Source listings of the computer codes are also provided. Author

N80-17030*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PREDICTION METHOD FOR TWO-DIMENSIONAL AERODYNAMIC LOSSES OF COOLED VANES USING INTEGRAL BOUNDARY-LAYER PARAMETERS
Louis J. Goldman and Raymond E. Augler Feb. 1980 43 p refs
(NASA-TP-1623; E-076) Avail: NTIS HC A03/MF A01 CSCL 01A

A generalized analysis to predict the two-dimensional aerodynamic losses of film-cooled vanes by using integral boundary-layer parameters is presented. Heat-transfer and trailing-edge injection effects are included in the method. An approximate solution of the generalized equations is also included to show more clearly the effect of the different boundary-layer and cooling parameters on the losses. The analytical predictions agree well with the experimental results, indicating that available boundary-layer calculations for cooled vanes are of sufficient accuracy to use in the prediction method. Author

N80-17031# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Dept. of Aerospace and Ocean Engineering.
APPROXIMATE ANALYSIS OF AXISYMMETRIC BASE FLOWS WITH INJECTION IN SUPERSONIC FLOW
J. A. Schetz, F. S. Billig, and S. Favin Blacksburg, Va. Virginia Polytech. Inst. and State Univ. 30 Oct. 1979 28 p refs
Backup document for AIAA synoptic, "Approximate analysis of axisymmetric supersonic base flows with injection", scheduled for publication in AIAA Journal, Jul. or Aug. 1980 sponsored by Naval Ordinance Systems Command
(VPI-Aero-099) Avail: NTIS HC A03/MF A01

The flow processes in the wake of a projectile moving in at supersonic speeds with mass addition to the base region were analyzed in order to accurately predict the pressure on the base so that base drag and its reduction due to injection could be estimated. The major assumptions are involved with the development of an approximate pressure-angle relation, modelling of turbulent transport processes and the use of one-dimensional or pseudo-one-dimensional flow equations in various regions of the flow. Comparisons with experiment at M(1) = 2.0 and 3.0 show that good predictions of base pressure can be achieved with a minimum of complexity. A.R.H.

N80-17032# ARO, Inc., Arnold Air Force Station, Tenn.
SEPARATED AND NONSEPARATED TURBULENT FLOWS ABOUT AXISYMMETRIC NOZZLE AFTERBODIES. PART 1: DETAILED SURFACE MEASUREMENTS Final Report, 1 Oct. 1976 - 30 Sep. 1977
J. A. Benek AEDC Oct. 1979 51 p refs
(AD-A077144; AEDC-TR-78-49-PT-1) Avail: NTIS
HC A04/MF A01 CSCL 20/4

Extensive static pressure data were obtained on a model consisting of a cone-ogive-cylinder forebody, two interchangeable circular arc afterbody boattails having length-to-forebody diameter ratios of 0.80 and 1.77, and two interchangeable solid exhaust plume simulators of cylindrical and contoured geometry. Boundary-layer pitot data and photographic records of model tufts and schlieren data were also obtained. Data were collected over a Mach number range of 0.60 to 1.30 and a unit Reynolds number range of 3.2 to 13.12 million per m (1 to 4 million per ft) at zero angle of attack and sideslip for the purpose of obtaining experimental data suitable for comparison with theoretical predictions. Data are presented for two model configurations with cylindrical solid plume simulators at three flow conditions: (1) length-to-diameter ratio = 1.77 boattail at Mach number number 0.80 and Reynolds number 8.2 million per m for high subsonic, unseparated flow; (2) length-to-diameter ratio = 0.80 boattail at Mach number 0.60 and unit Reynolds number 8.2 million per m for subsonic, separated flow; and (3) length-to-diameter ratio = 0.80 boattail at Mach number 0.95 and unit Reynolds number 8.2 million per m for transonic, separated flow with boundary-layer-shock interaction. GRA

N80-17033# McDonnell-Douglas Research Labs., St. Louis, Mo.
UNSTEADY TRANSONIC FLOWS IN A TWO-DIMENSIONAL DIFFUSER Annual Technical Report, 1 Apr. 1978 - 31 Mar. 1979
M. Sajben and J. C. Kroutil 31 May 1979 27 p refs
(Contract F49620-77-C-0082; AF Proj. 2307)
(AD-A075261; AFOSR-79-0990TR) Avail: NTIS
HC A03/MF A01 CSCL 20/4

The second and third years of the contract comprise its second phase, aimed at exploring the effects of periodic, downstream excitation on the transonic flow in a two-dimensional diffuser model. The present report covers the second year of the contract. The pulse generator was incorporated in the diffuser model, and its controls were synchronized with the optical instrumentation. The boundary-layer control system was turned for best two-dimensionality of the flow. The flowfield instrumentation was selected, and an appropriate actuator was constructed. Perturbation of the flow by the actuator was determined to be acceptably small. Boundary-layer profiles were determined on all four walls, and the Mach number distribution was mapped in detail over the diffuser exit cross-section. Surface pressure distributions were measured, and spark schlieren photos were taken for the available pressure ratio range. GRA

N80-17034# Boeing Military Airplane Development, Seattle, Wash. Military Airplane Development Organization.
FORMULATION OF THE THREE DIMENSIONAL TRANSONIC UNSTEADY AERODYNAMIC PROBLEM Interim Report, 15 May 1978 - 15 Feb. 1979
H. Yoshihara Feb. 1979 87 p refs
(Contract F33615-78-C-3201; AF Proj. 2401)
(AD-A075403; AFFDL-TR-79-3030) Avail: NTIS
HC A05/MF A01 CSCL 20/4

Unsteady transonic flow for a swept wing of moderate sweep is formulated in the small disturbance limit. Boundary conditions at the wing, the trailing vortex sheet, and the outer computational boundaries are given including the ventilated wall conditions. Shortcomings of the small disturbance hypothesis is reviewed, suggesting means to compensate for them. Viscous interactions are described together with procedures to incorporate their effects. GRA

N80-17035# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
SYNTHESIS OF UNSTEADY AERODYNAMIC PROBLEMS CONCERNING HELICOPTERS [SYNTHESE DES PROBLEMES D'AERODYNAMIQUE INSTATIONNAIRE DE L'HELICOPTERE]
J. Gallot Paris Assoc. Aeron. et Astronautique de France 1979 22 p refs In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-19; ISBN-2-7170-0546-3) Avail: NTIS

HC A02/MF A01; CEDOCAR, Paris FF 17 (France and EEC) FF 21 (others)

The impact of unsteady phenomena on the performance of a rotary wing as well as on overall helicopter performance is discussed with emphasis on the ways in which manufacturers try to take these effects into consideration at the design stage. Criteria taken into consideration include operating conditions for different profiles, problems associated with unsteady operation, and the impact of these problems on flight performance. The validity of mathematical models which predict unsteady aerodynamic phenomena, such as flow separation and compressibility is discussed and found to be good at the industrial design level.
Author (ESA)

N80-17036# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

EXPERIMENTAL STUDY OF THE AERODYNAMICS OF A HELICOPTER ROTOR BLADE MODEL IN AN UNSTEADY FLOW REGIME DURING WIND TUNNEL TESTS

P. Philippe, P. Lafon, and J. C. Bohl 1979 13 p refs In FRENCH; ENGLISH summary Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-21; ISBN-2-7170-0548-X) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 17 (France and EEC) FF 21 (others)

Test tools and facilities were developed to understand and analyze flows encountered on helicopter rotor blades. The measurements performed on straight or 30 deg swept blade tips reveal unsteady and tridimensional effects on absolute pressure distributions. The experimental data are also compared with calculations, thus summing up the state of art of available prediction methods.
Author (ESA)

N80-17037# Technische Hochschule, Aachen (West Germany). Inst. fuer Luft u. Raumfahrt.

INVESTIGATION OF THE FLIGHT MECHANICS AND AERODYNAMICS OF THE GROUND EFFECT PRINCIPLE [FLUGMECHANISCHE UND AERODYNAMISCHE UNTERSUCHUNGEN ZUM STAUFLUEGELPRINZID]

M. Haake, G. Kleineidam, and R. Staufenbiel Bonn Dokzentbw Feb. 1979 111 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(Contract T/RF-41/RF-410/51109)
(BMVg-FBWT-79-4) Avail: NTIS HC A06/MF A01; Dokzentbw, DM 40

The relationship between aerodynamic configurations and ground effect flight characteristics are reported. Static longitudinal stability with particular reference to height stability is discussed. Longitudinal motion which shows three stable modes with sufficient damping by a suitable selection of the aerodynamic configuration is examined. Variation of thrust is found to be best suited for controlling the height. A wind tunnel measurement technique is presented which allows direct evaluation of the height stability. Pressure distributions and aerodynamic coefficients are determined theoretically and experimentally. A plate with boundary layer suction used to simulate the ground is described. Thin and moderately cambered airfoils are examined and the influence of the deformation of the wake is reported.
Author (ESA)

N80-17038# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).

THE ANALYSIS OF MEASURED SURFACE LOADS AS A BASIS FOR THE DERIVATION OF ACCEPTABLE LOAD LIMITS FOR MILITARY AIRCRAFT COMPONENTS [DIE ANALYSE VON GEMESSENEN BETRIEBSBEANSPRUCHUNGEN ALS GRUNDLAGE FUER DIE ABLEITUNG VON LASTANNAHMEN FUER MILITAERISCHES FLUGGERAET]

J. M. Azschel and V. Ladda Bonn Dokzentbw May 1979 76 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(Contract T/RF-43/RF-430/51038)
(BMVG-FBWT-79-9) Avail: NTIS HC A05/MF A01; Dokzentbw, DM 30

Recent investigations into gust loads on airplanes are reviewed using the theory of turbulence and its application to problems associated with flight in turbulence. The statistical description of turbulence and the dynamic response of the structure due to gusts are considered. In most cases, the results are presented in terms of cumulative frequency distributions and power spectra for independent gust components. The statistical dependence of the components is omitted in this case even though it must be considered for example in the design of T-tails. More information is needed regarding the gust gradients which must be known when assuming a single gust model for the design of aircraft components. Models which were developed and verified by means of measured load-time histories during service are presented to aid in solving the problems addressed.
Author (ESA)

N80-17039# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.

VORTEX SHEDDING FROM SHARP EDGES

J. M. R. Graham Nov. 1977 28 p refs
(IC-Aero-77-06; ISSN-0308-7247) Avail: NTIS HC A03/MF A01

Numerical methods of shedding point vortices in inviscid two-dimensional flow past a sharp edge and the subsequent roll up of the shed vortex sheet are discussed. The results of some numerical calculations are presented. Author (ESA)

N80-17040# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.

DESCRIPTION AND REPORT ON THE CALIBRATION OF AN UNSTEADY FLOW WIND TUNNEL, PART 1. THE UNSTEADY LIFT GENERATED ON AN AIRFOIL AT MODERATE INCIDENCE TO A FLOW CONTAINING STREAMING OSCILLATIONS, PART 2

J. M. R. Graham May 1979 24 p refs
(IC-Aero-79-04-Pt-1/2; ISSN-0308-7247) Avail: NTIS HC A02/MF A01

A first set of velocity and pressure measurements made in an unsteady flow wind tunnel are presented. The wind tunnel provides a low speed mean flow superimposed streamwise oscillations of variable amplitude generated by rotating vanes at the downstream end. The fluctuating lift on an unstalled airfoil at incidence in an unsteady streamwise flow was measured and compared with predictions of unsteady thin airfoil theory.
Author (ESA)

N80-17041# Royal Aircraft Establishment, Farnborough (England).

HOLOGRAPHIC INTERFEROMETRY OF CARBON FIBER REINFORCED PLASTIC WINGTIPS

M. Marchant London HMSO Aug. 1978 63 p refs
(RAE-TR-78105; BR68663) Avail: NTIS HC A04/MF A01

Seven experimental Harrier ferry-tips were examined by holographic interferometry primarily for defects in core to skin bonding. With increasing experience, the quality of the holograms recorded improved and although the interference patterns formed when the structure is warmed are often complicated, discontinuities are readily observed. A number of suspected defects were found which are virtually undetectable using standard radiographic techniques. The most prominent of these are the long straight anomalies visible on all but the first sample examined. It is thought that they may be due to overlapping sheets of film adhesive, but this was not established with certainty. An ultrasonic scan of one sample also failed to detect it. Small circular patterns, possibly indicating debonds, were found in a number of place. A group of large anomalies observed on one sample were confirmed by radiography. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N80-17042# Lockheed-California Co., Burbank.

GENERAL AVIATION AIRPLANE STRUCTURAL CRASHWORTHINESS USER'S MANUAL. VOLUME 2: INPUT-

OUTPUT, TECHNIQUES AND APPLICATIONS Final Report, Jun. 1976 - Feb. 1978
Max A. Gamon, Gil Wittlin, and William L. LaBarge Sep. 1979 253 p
(Contract DOT-FA75WA-3707)
(AD-A075949; LR-28307-Vol-2-Rev; FAA-RD-77-189-Vol-2-Rev) Avail: NTIS HC A12/MF A01 CSCL 01/3

A comprehensive description of program KRASH is provided. The following are included: user's guide; math model development; KRASH data requirements; and typical model arrangements. R.C.T.

N80-17043# National Aviation Facilities Experimental Center, Atlantic City, N. J.
ACCIDENT DATA SYSTEMS STUDY REQUIREMENTS ANALYSIS FOR A FAA ACCIDENT DATA SYSTEM Final Report, Oct. 1977 - Jul. 1979
Ellis V. Couch, Ron M. Hill, T. Kolankiewicz, and Gerald Skelton Aug. 1979 167 p refs
(FAA Proj. 014-100-100)
(AD-A075611; FAA-NA-79-172) Avail: NTIS HC A08/MF A01 CSCL 01/2

The Federal Aviation Administration is investigating possible improvements in its accident data system to enhance aviation safety because the present data system is limited in scope, difficult to use, and of little benefit to aviation safety analysts. The immediate needs which can be met in the near term as well as improvements which will necessitate extensive changes in data collection forms, procedures, and methodologies are analyzed. Other similar data systems are examined, previous related studies are reviewed, and recommendations from users of accident data systems are surveyed. The FAA Flight Standards Service incorporated additional data elements, improved software for better data access, and other near term improvements in the General Aviation Accident Data System now under development. These improvements are evolutionary steps toward the fulfillment of the long range requirements. A.R.H.

N80-17044# Air Force Academy, Colo. Research Lab.
CARGO GENERATION FORECASTING MODELS
John S. Brush Oct. 1979 11 p refs
(AF Proj. 2304)
(AD-A076136; FJSRL-TR-79-0010) Avail: NTIS HC A02/MF A01 CSCL 15/5

Time series models of daily cargo generated for two MAC channels are developed. The strong weekly cyclical fluctuation is exploited in developing forecasting models using both past cargo generation and past cargo arrivals as inputs. GRA

N80-17045# Dayton Univ., Ohio.
THE SCALING OF BIRD IMPACT LOADS Final Report, 16 Jan. 1978 - 16 Feb. 1979
Antonios Challita and John P. Barber Jun. 1979 67 p refs
(Contract F33615-78-C-3402; AF Proj. 2402)
(AD-A075215; UDR-TR-79-23; AFFDL-TR-79-3042) Avail: NTIS HC A04/MF A01 CSCL 14/2

This report describes an experimental study which was conducted to investigate the loads produced by the impact of 1800 g and 3600 g birds. Both real birds and bird simulants were tested. Impact pressures were measured and compared with smaller bird impact results obtained on previous testing programs. The magnitude of the impact pressures was found to be independent of bird size. The temporal and spatial distribution of impact pressures scaled linearly with bird dimensions. The impact behavior of large birds was consistent with flow models developed to describe small bird impacts. It was concluded that large and small birds display the same fundamental impact loading processes and that these processes are adequately described by the previously developed flow model. GRA

N80-17046# Douglas Aircraft Co., Inc., Long Beach, Calif.
ADVANCED DESIGN AIRCREW PROTECTIVE RESTRAINT SYSTEMS Final Report
A. Blair McDonald Aug. 1979 59 p refs
(Contract F33615-78-C-0509)
(AD-A076061; AMRL-TR-79-45) Avail: NTIS HC A04/MF A01 CSCL 01/3

This study is the initial phase of a program aimed at the development of advanced design aircrew systems for the next generation of Air Force combat aircraft. For these new aircraft, it is anticipated that combat operations will involve high multiaxial acceleration maneuvers and that new aircrew systems will be required for restraint, protection and escape under these combat conditions. GRA

N80-17268 Air Force Materials Lab., Wright-Patterson AFB, Ohio.
BIRD IMPACT LOADING
J. S. Wilbeck and J. P. Barber (Dayton Univ. Research Inst., Ohio) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 115-122 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington D.C.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N80-17047# Federal Aviation Administration, Washington, D. C. Flight Transportation Lab.
REVIEW AND EVALUATION OF NATIONAL AIRSPACE SYSTEM MODELS Final Report, Jan. - Dec. 1978
A. R. Odoni and R. W. Simpson Oct. 1979 357 p refs
(Contract DOT-TSC-1491)
(AD-A078050; FAA-EM-79-12; DOT-TSC-FAA-79-8) Avail: NTIS HC A16/MF A01 CSCL 17/7

A guide to the availability and capability of state of the art analytical and simulation models of the national airspace system (NAS) is presented. A listing of 230 reports containing technical descriptions of models developed during the last decade are reviewed with 50 distinct models described. The reports are classified into primary categories based on applicability of the model to various aspects of the NAS. Capacity/delay models are classified as capacity oriented runway, delay oriented runway, complete airport, terminal airspace, air route traffic (including communications), controller workload and performance, and models of major segments of the NAS. Reports describing models primarily concerned with safety related measures and noise related measures are categorized separately. Information contained in each model review includes report ID, abstract, input/output parameters, computer related characteristics, assumptions, quality of documentation, extent of validation, and an evaluation of the model's usefulness and limitations. The reports also contain a comparative evaluation of models in the same primary category. These evaluations present an overview of the models contained in each category, summarize the main features of the best models, and document the conclusions and recommendations regarding the model best suited for specific applications. A.W.H.

N80-17048# National Aviation Facilities Experimental Center, Atlantic City, N. J.
SUMMARY OF TRANSPONDER DATA Interim Report, Jun. 1977 - Aug. 1978
Max Greenberg Aug. 1979 53 p refs
(FAA Proj. 031-241-830)
(AD-A075486; FAA-RD-79-56; FAA-NA-79-23) Avail: NTIS HC A04/MF A01 CSCL 17/7

The performance characteristics of transponders and digitized encoded altimeters were determined in the operational environment of general aviation aircraft. A transponder performance analyzer (TPA), developed to measure performance parameters of transponders installed in aircraft is described. The TPA installed in a bus for mobility, simulates an air traffic control beacon interrogator to facilitate measurement of 15 transponder parameters in 30 seconds. A standard gain horn is utilized to couple the signals between the TPA bus and the aircraft. Transponder data were collected at four different geographic locations resulting in more than 950 samples of general aviation transponders. Results presented in tabular form, show that 36 percent of the transponders met all measured parameters. The TPA operation and procedures are reported and the data collection and sampling techniques are discussed. A.W.H.

N80-17049# National Aviation Facilities Experimental Center, Atlantic City, N. J.
COMPUTER STUDY OF TULSA INTERNATIONAL AIRPORT RUNWAY 17R GLIDE SLOPE SITES Final Report, Feb. - Nov. 1978
Thomas J. Laginja Sep. 1979 44 p refs
(FAA Proj. 071-713-800)
(AD-A075521; FAA-RD-79-27; FAA-NA-79-8) Avail: NTIS HC A03/MF A01 CSCL 17/7

The effect of the terrain at the approach end of Tulsa International Airport runway 17R on guidance signals radiated from an instrument landing system glide slope antenna system is examined. The performances of capture effect, sideband reference, and null reference systems were compared using a mathematical simulation model in order to select the antenna system that will result in the least perturbation of signal. The model, the modeling technique, and the application of the model are described along the input data. A.W.H.

N80-17050# Federal Aviation Administration, Washington, D. C. Office of Systems Engineering Management.
REPORT ON THE FAA TASK FORCE ON AIRCRAFT SEPARATION ASSURANCE. VOLUME 2: CONCEPT DESCRIPTION
N. A. Blake Jan. 1979 69 p refs
(AD-A077807; FAA-EM-78-19-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 17/7

The development of the integrated aircraft separation assurance (ASA) system for the National Airspace System is discussed with emphasis on system errors, mid-airs, and near mid-airs, and altitude deviations. The system element requirements are defined to provide two levels of backup to the ATC system: a separation violation warning and a final fail safe collision advisory and resolution function. The current FAA ASA development programs are discussed as well as the changes required to transition to an integrated ASA system. A.R.H.

N80-17051# National Aviation Facilities Experimental Center, Atlantic City, N. J.
DEFORMOGRAPHICS: HIGH-RESOLUTION PROJECTION DISPLAY DEVELOPMENT FOR AIR TRAFFIC CONTROL PURPOSES Report, Jan. 1973 - Dec. 1978
Gerard Spanier Oct. 1979 224 p refs
(FAA Proj. 975-200-00A)
(AD-A078023; FAA-NA-79-24) Avail: NTIS HC A10/MF A01 CSCL 17/7

A display device and technology called deformographics is described and its practical value for the presentation of large quantities (e.g., 30,000 characters) of air traffic control data was investigated. The engineering, development, human factors, and test and evaluation phases are included and the technical performance data and applications concepts are provided. The project determined the viability of the technology, established the basis for further operational concept studies, and assessed the reproducibility of devices and performance based on the technology. The results indicate a wide use of the technology for air traffic control data and information presentation, as well as other similar applications, and indicate a significant superiority of performance over other conventional and emerging display technologies. R.C.T.

N80-17052# Analysis and Technology, Inc., North Stonington, Conn.
TARGET TRACKING WITH MULTIPLE DATA SOURCES Final Report
H. F. Jarvis and N. B. Nill 15 Aug. 1979 137 p refs
(Contract N00014-78-C-0707)
(AD-A076559; P-515-1-79) Avail: NTIS HC A07/MF A01 CSCL 17/7

This report presents the results of a study on the impact of a priori estimates of range and/or target speed on the bearings-only TMA problem. The method selected for this evaluation was a computer simulation of Maximum A posteriori Probability (MAP) estimate which incorporates the a priori statistical information in an asymptotically optimum manner. The a priori range information represents environmental predictions of likely range bands based on alternate propagation paths (direct, 1st CZ, 2nd CZ, etc.). An additional phase of the study evaluated the use of Depression/Elevation (D/E) estimates from environmental predictions for resolving horizontal bearing from conical angle measurements. The results of the study indicate that the benefits achieved from the use of a priori range information are algorithm dependent and primarily aid numerical convergence rather than solution accuracy. The use of a priori range together with estimated D/E does provide solution improvement for conical angle measurements from line arrays. The use of speed estimates improves both numerical convergence and solution quality during the initial TMA legs. GRA

N80-17053# Armament Development and Test Center, Eglin AFB, Fla.
PROCEEDINGS OF THE BIENNIAL GUIDANCE TEST SYMPOSIUM, 9TH, VOLUME 1
Oct. 1979 393 p refs Symp. held at Holloman Air Force Base, New Mexico, 10-12 Oct. 1979
(AD-A076567; ADTC-TR-79-11-Vol-1) Avail: NTIS HC A17/MF A01 CSCL 17/7

These proceedings contain papers included in the Ninth Biennial Guidance Test Symposium. This symposium, hosted by the Central Inertial Guidance Test Facility, is directed toward the exchange of information, stimulation of new ideas, and discussion of recent developments in the field of guidance testing. The papers presented include such topics as the Global Positioning System, the Space Shuttle, Aircraft Inertial Navigators, Component Evaluation, Advanced Guidance Methodology, Missile Guidance Systems and Analysis Techniques. GRA

N80-17054# Analytical Systems Corp., Burlington, Mass.
LORAN-C SYSTEM DYNAMIC MODEL: TEMPORAL PROPAGATION VARIATION STUDY Final Report, 1 Oct. 1978 - 30 Apr. 1979
L. W. Campbell, R. H. Doherty, and J. R. Johler Jul. 1979 63 p refs Prepared in cooperation with Colorado Research and Prediction Lab., Boulder
(Contract DOT-CG-829358-A)
(AD-A076214; ASECR-79-107; USCG-D57-79) Avail: NTIS HC A04/MF A01 CSCL 20/14

The results of a theoretical study to determine the expected extent of temporal variations in the Loran-C System are presented. Graphs of secondary phase correction vs distance, parametric in vertical lapse factor, for six values of ground impedance and parametric in ground impedance, for three values of vertical lapse factor are included. Although the secondary phase correction is most sensitive to ground impedance, it is relatively time stable and the most important parameter of concern in temporal variations is the vertical lapse factor. The effect of the surface refractive index on the secondary phase correction is negligible except in so far as it is correlated with the vertical lapse factor. A flow diagram and description of a program suitable for use on a desk calculator to calculate the secondary phase correction is included. GRA

N80-17055# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.
SIZE EFFECT ON NAVIGATION USING A STRAPDOWN IMU
J. C. Hung, J. S. Hunter, W. W. Stripling, and H. V. White 27 Jun. 1979 29 p
(AD-A075434; DRSMI-T-79-73) Avail: NTIS HC A03/MF A01 CSCL 17/7

Size effects in a strapdown IMU (Inertial Measurement Unit) are not always ignorable. They should be considered in the error budget for high accuracy inertial navigation. This report presents results of a study on size effects. It is found that while each individual accelerometer has only one type of size effect, an IMU has two in general, the 'mounting offset size effect' and the cluster size effect. General formulas for determining IMU size effect errors are developed in the report. Numerical examples, laboratory test results, and flight simulation results are given to demonstrate the size effects and to reveal their effect on navigation error. It is discussed that an optimum orientation for the accelerometer cluster can be chosen to minimize the navigation errors caused by size effects. It is also shown that, in principle, size effect of an IMU can be compensated using the angular rate information available from gyros. A size effect compensation concept is proposed with the associated computation algorithm given. GRA

N80-17056# Defence Research Establishment Valcartier (Quebec).
AREA CORRELATION TRACKING WITH AUTOMATIC COMPENSATION FOR MAGNIFICATION AND ROTATION
C. Munteanu Jul. 1979 72 p refs
(AD-A073011; DREV-R-4140/79) Avail: NTIS HC A04/MF A01 CSCL 17/8

Target tracking by area correlation involves matching a stored reference image of the target to live search scenery. The performance of the area correlator can be severely degraded by target magnification and three-axis rotation. This report presents 2 algorithms that estimate magnification and rotation angles, and allow the tracker to take compensating action via zoom lens and roll gimbal. The first algorithm, applicable to fixed targets, estimates rotation about the line of sight only (roll angle). The second algorithm estimates rotation in 3 axes, as required for maneuvering targets. The presentation of both algorithms is supported by simulation using photographs and artificial images. GRA

N80-17057# Champlain Technology Industries, Palo Alto, Calif.
AIRBORNE EVALUATION OF THE PRODUCTION AN/ARN-133 LORAN-C NAVIGATOR Final Report
Richard J. Adams and John B. McKinley Jul. 1979 260 p refs
(Contract DOT-FA75WA-3662)
(AD-A075484; USCG-D-32-79) Avail: NTIS HC A12/MF A01 CSCL 17/7

This report presents the results of a comprehensive flight test evaluation of a production airborne Loran-C navigator. The test was performed on a FAA approved helicopter route in the Northeast Corridor, at NAFEC in Atlantic City, New Jersey and in the Gulf of Mexico. The test aircraft used were United States Coast Guard HH52 and HH53 helicopters. The test period was from June 1978 to January 1979. The test plan and test objectives were developed jointly by the United States Coast Guard and the Federal Aviation Administration and Systems Control, Inc. (Vt), Champlain Technology Industries Division. The flight test profiles and procedures were developed for the following reasons: (1) to assess the acceptability of Loran-C navigation in the operational ATC environment of the Northeast Corridor; (2) to determine the system use accuracy for Loran-C for enroute, terminal and non-precision approach flight; (3) to evaluate the Loran-C navigator performance in several offshore missions. The primary conclusions of this flight test evaluation were: the navigator was acceptable in the operational environment of the Northeast Corridor for both enroute and point-in-space approaches; the navigator satisfied AC 90-45A crosstrack accuracy requirements for enroute, terminal area and non-precision approaches; the production navigator satisfied a longtrack AC 90-45A accuracy requirements for enroute and terminal area, but not for non-precision approaches; the navigator performed acceptably during all phases of offshore testing. GRA

N80-17058# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
THE MODELING ERROR COMPENSATION OF DIGITAL FILTERS FOR THE ALIGNMENT OF INERTIAL PLATFORMS
Srinivasan Vathsal 1979 41 p refs
(DFVLR-FB-79-19) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 8,80

The modeling error compensation of digital filters for the alignment of inertial platforms is considered. A feedback compensator was derived using singular control concepts by minimizing the actual estimation error without increasing computer loading. Numerical results are presented for two specific cases. A minimax design to consider worst cases of the platform and measurement noise disturbances in the real world model is given. Author (ESA)

N80-17059# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
COLORED MEASUREMENT NOISE DIGITAL PREFILTERING BY REGRESSION LINES
Rainer Froriep May 1979 58 p refs
(DFVLR-Mitt-79-05) Avail: NTIS HC A04/MF A01; DFVLR, Cologne, West Germany DM 10,80

The fast initial fine alignment of an inertial platform with a Kalman filter, accelerated by a digital prefilter, is shown. The digital prefilter has the task to estimate certain state variables by constructing linear mean square regression lines from each batch of measurements with colored noise. The developed prefilter is characterized by a brief computation time and small storage requirements, which makes a very high data rate possible. The choice of filter structure and parameters is discussed referring to simulation results. The filter algorithm is illustrated step by step, both on-line and off-line. It is compared to prefiltering averaging and is shown to perform well. Author (ESA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-17060*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPARISON OF ANALYTICAL AND FLIGHT TEST IDENTIFIED AERODYNAMIC DERIVATIVES FOR A TANDEM-ROTOR TRANSPORT HELICOPTER
Ward F. Hodge Feb. 1980 56 p refs
(NASA-TP-1581; L-13228) Avail: NTIS HC A04/MF A01 CSCL 01C

Flight tests for verifying an analytical aerodynamic derivative model of a CH-47 helicopter were conducted for low cruise speeds and transition to hover portions of curved, decelerating landing approach trajectories. All testing was performed on a closed loop basis with the stability augmentation system of the helicopter operating, and response data were obtained using both manual and computer generated input maneuvers. The results indicate some differences between the measured response time histories and those predicted by both analytical and flight test identified derivatives. With some exceptions the discrepancies are not severe, and the overall agreement between the measured and computed time histories is reasonably good. No adverse effects attributable to closed loop testing were noted, and the use of computer generated inputs proved to be superior to manual ones. Author

N80-17061*# Missouri Univ. -Rolla. Dept. of Mechanical and Aerospace Engineering.
AERODYNAMIC-STRUCTURAL ANALYSIS OF DUAL BLADED HELICOPTER SYSTEMS Final Technical Report
Bruce P. Selberg, Donald L. Cronin, Kamran Rokhsaz, John R. Dykman, and Carla J. Yager Feb. 1980 46 p refs
(Grant NsG-2375)
(NASA-CR-162754) Avail: NTIS HC A03/MF A01 CSCL 01C

The aerodynamic and structural feasibility of the birotor blade concept is assessed. The inviscid flow field about the dual bladed rotor was investigated to determine the aerodynamic characteristics for various dual rotor blade placement combinations with respect to blade stagger, gap, and angle of attack between the two blades. The boundary layer separation on the rotors was studied and three dimensional induced drag calculations for the dual rotor system are presented. The thrust and power requirements of the rotor system were predicted. NASTRAN, employed as the primary modeling tool, was used to obtain a model for predicting in plane bending, out of plane bending, and the torsional

behavior of the birotors. Local hub loads, blade loads, and the natural frequencies for the birotor configuration are discussed.
A.W.H.

N80-17062*# Arde, Inc., Mahwah, N.J.
DESIGN STUDY OF PRESTRESSED ROTOR SPAR CONCEPT Final Report, Mar. 1975 - Jun. 1976
David Gleich Jan. 1980 101 p refs Sponsored in part by the Army Aviation Res. and Develop. Command
(Contract NAS1-13816)
(NASA-CR-159086; ARDE-J/N-41005) Avail: NTIS HC A06/MF A01 CSCL 01C

Studies on the Bell Helicopter 540 Rotor System of the AH-1G helicopter were performed. The stiffness, mass and geometric configurations of the Bell blade were matched to give a dynamically similar prestressed composite blade. A multi-tube, prestressed composite spar blade configuration was designed for superior ballistic survivability at low life cycle cost. The composite spar prestresses, imparted during fabrication, are chosen to maintain compression in the high strength cryogenically stretchformed 304-L stainless steel liner and tension in the overwrapped HTS graphite fibers under operating loads. This prestressing results in greatly improved crack propagation and fatigue resistance as well as enhanced fiber stiffness properties. Advantages projected for the prestressed composite rotor spar concept include increased operational life and improved ballistic survivability at low life cycle cost. M.M.M.

N80-17063# Lockheed-Georgia Co., Marietta.
AERODYNAMIC INVESTIGATION OF C-141 LEADING EDGE MODIFICATION FOR CRUISE DRAG REDUCTION, VOLUME 1. Final Technical Report, Jun. 1977 - Sep. 1978
W. T. Blackerby and P. R. Smith Wright-Patterson AFB, Ohio AFFDL Jun. 1979 172 p refs
(Contract F09603-77-A-0204; AF Proj. 2404)
(AD-A076610; LG78ER0233-Vol-1; AFFDL-TR-79-3059-Vol-1)
Avail: NTIS HC A08/MF A01 CSCL 01/3

A study was made of the aerodynamic design and high speed wing tunnel investigation of wing leading edge modifications for cruise drag reduction on the C-141 aircraft. Also investigated were the effects of a wing swept tip extension and trailing edge anti-drag bodies. These modifications were tested in the AEDC 16-Foot Transonic Facility, using a 0.044 scale C-141B model, to determine the effects on C-141 cruise aerodynamic characteristics and wing chordwise pressure distributions. Design of the leading edge modifications was based on the use of transonic wing theory, transonic airfoil theory and experience previously gained with a two-dimensional airfoil leading edge modification program. Force data results were analyzed to determine the effects on C-141 cruise drag, drag rise characteristics and cruise performance. Correlations were made with transonic theory using the measured chordwise pressure distributions. A fuel and cost savings evaluation was made of the selected leading edge configuration based on measured and predicted cruise performance improved. GRA

N80-17064# McDonnell Automation Co., St. Louis, Mo.
EFFECT OF SERVICE ENVIRONMENT ON F-15 BORON/EPOXY STABILATOR Final Report, Aug. 1977 - Jun. 1979
T. V. Hinkle Jun. 1979 137 p refs
(Contract F33615-77-C-3124; AF Proj. 2401)
(AD-A076493; AFFDL-TR-79-3072) Avail: NTIS HC A07/MF A01 CSCL 11/4

The objective of this program was to conduct a series of tests for evaluating the effects of service environment on the strength of the boron/epoxy skins which are an integral part of the F-15 horizontal stabilator. Full scale static tests were conducted on two stabilators, and test results were compared with the capability of the F-15 stabilator demonstrated in previous testing. Moisture contents at various locations in the composite skins were predicted by evaluating the environmental histories of both test articles. Predicted contents were corroborated by moisture contents measured at conclusion of the static tests. F-15 deployments were projected for a 25 year service life, and moisture contents of stabilator composite skins were calculated for each projected deployment. Structural element tests were conducted under the maximum temperature and absorbed moisture conditions expected in service. Physical and chemical characteristics of the test article skins were evaluated relative to baseline boron/epoxy characteristics. GRA

N80-17065# Army Command and General Staff Coll., Fort Leavenworth, Kansas.
THE A-10 AND DESIGN-TO-COST: HOW WELL DID IT WORK?
Roger E. Carleton May 1979 52 p refs
(AD-A075437) Avail: NTIS HC A04/MF A01 CSCL 05/1

This document covers systems procurement in a design-to-cost atmosphere. Deficiencies in this program are identified and recommendations are offered to improve this lack of responsiveness. GRA

N80-17066# Center for Naval Analyses, Alexandria, Va. Operations Evaluation Group.
THE ACCELEROMETER METHODS OF OBTAINING AIRCRAFT PERFORMANCE FROM FLIGHT TEST DATA DYNAMIC PERFORMANCE TESTING
William R. Simpson Jun. 1979 402 p refs
(AD-A075226; CNA-PP-245) Avail: NTIS HC A18/MF A01 CSCL 01/3

There are, in general, two basic methods of obtaining aircraft performance from flight test data. The first of these methods, the Direct method, is to fly a particular maneuver of interest and mathematically correct this maneuver to a given set of standard conditions. Several similar maneuvers at different flight conditions are then combined in a composite map representing one aspect of the aircraft performance. The Indirect method is more subtle and has its basis deeper in theory. By this method, a group of aerodynamic and propulsion parameters are developed which in themselves are only numbers and do not represent performance. These parameters are not tied to a specific maneuver or maneuver type, but in general relate the physical forces required to achieve a certain flight condition. Such parameters for an aircraft would be the drag coefficient, lift coefficient, thrust available, fuel flow requirements, etc. However, these parameters can be combined with known facts about the airframe and propulsion system in such a fashion as to compute airplane performance. With the advent of highly accurate accelerometers, the dynamic maneuvers have become attractive for development of aerodynamic data when obtaining aircraft performance using the Indirect Method. GRA

N80-17067# Textron Bell Helicopter, Fort Worth, Tex.
INVESTIGATION OF THE CRASH-IMPACT CHARACTERISTICS OF ADVANCED AIRFRAME STRUCTURES Final Report
James D. Cronkhite, Thomas J. Haas, Victor L. Berry, and Robert Winter Sep. 1979 222 p refs
(Contract DAAJ02-77-C-0062; DA Proj. 1L2-62209-AH-76)
(AD-A075163; USARTL-TR-79-11) Avail: NTIS HC A10/MF A01 CSCL 01/3

The purpose of this program was to investigate the crash-impact characteristics of advanced troop transport helicopter airframe structures constructed of composite materials. Currently available information was surveyed on the crash-impact behavior of composite materials, analytical tools for design of crashworthy airframe structures, and airframe structure crashworthiness design criteria. Information on the crash-impact behavior of composite materials was found to be limited. Automotive studies showed that by innovative design, composite materials could function efficiently as energy absorbers to reduce crash-impact loads. Other pertinent studies were found that are currently in progress at Bell Helicopter Textron, the NASA Langley Research Center and the U.S. Army's Research and Technology Laboratories and are summarized. Finally, effects of composite materials on the compliance of airframe structures with current Army crashworthiness requirements are discussed. GRA

N80-17068# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
THE APPLICATION OF A PARAMETERIC METHOD OF FATIGUE LOAD MEASUREMENT TO WINGS BASED ON FLIGHT MEASUREMENTS ON A LIGHTNING MK T5
Anne Burns, J. P. Thompson, and G. E. King HMSO Nov. 1977 59 p refs Supersedes RAE-TR-77178 and ARC-37708
Original contains color illustration

(ARC-R/M-3836; BR69023; ISBN-0-11-471169-0; RAE-TR-77178; ARC-37708) Avail: NTIS HC A04/MF A01; HMSO £10.00; PHI

The application of a parametric method for deriving fatigue loads for fighter aircraft wings is studied. The load is deduced from a statistical correlation with an appropriate combination of aircraft motion variables and control surface angles. The combined effect of symmetric and asymmetric loading is considered. Flights measurement are centered on Lightning fighter aircraft, but the scope is limited by the lack of ground load calibrations for the wing strain gages. This necessitated the development of parametric formulas for local rather than overall loads. Author (ESA)

N80-17069# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.

SESAME: A SYSTEM OF EQUATIONS FOR THE SIMULATION OF AIRCRAFT IN A MODULAR ENVIRONMENT

B. N. Tomlinson London HMSO Jan. 1979 151 p refs
(RAE-TR-79008; BR68659) Avail: NTIS HC A08/MF A01

A system of equations was developed for the simulation of aircraft motion in real time using a digital computer. Those parts of the mathematical model common to all aircraft were created as a set of FORTRAN subroutines, leaving the user to create only a small group of routines specifically to describe a particular aircraft. The equations employed are defined and the computer implementation described. The data presented can be used as a handbook and user guide. Because the routines described are not specific to real time simulation, they can also be used as a basis for a general mathematical model of an aircraft for use on any computer which handles FORTRAN. Author (ESA)

N80-17278 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

CALCULATION OF NATURAL FREQUENCIES AND MODE SHAPES OF MASS LOADED AIRCRAFT STRUCTURES

P. Wayne Whaley *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 13-20 (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17299*# Rockwell International Corp., Los Angeles, Calif.

SELECTED TOPICS FROM THE STRUCTURAL ACOUSTICS PROGRAM FOR THE B-1 AIRCRAFT

Peter M. Belcher *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 55-68 refs (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation and 35 Instrumentation and Photography.*

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-17070# National Aviation Facilities Experimental Center, Atlantic City, N. J.

EXHAUST EMISSIONS CHARACTERISTICS FOR A GENERAL AVIATION LIGHT-AIRCRAFT AVCO LYCOMING TIO-540-J2BD PISTON ENGINE Final Report

Eric E. Becker Sep. 1979 101 p refs
(FAA Proj. 201-521-100)
(AD-A075355; FAA-RD-79-68; FAA-RD-79-36) Avail: NTIS HC A06/MF A01 CSCL 21/7

The TIO-540-J2BD engine (S/N890-X) was tested at the National Aviation Facilities Experimental Center to develop a steady state exhaust emissions data base. This data base consists of current production baseline emissions characteristics, lean-out emissions data, effects of leaning-out the fuel schedule on cylinder head temperatures, and data showing ambient effects on exhaust emissions and cylinder head temperatures. The engine operating with its current full-rich production fuel schedule could not meet the proposed Environmental Protection Agency standard for carbon monoxide and unburned hydrocarbons (HC) under sea level standard-day conditions. The engine did, however, meet the proposed EPA standards for oxides of nitrogen under the same sea level conditions. The results show a trend toward higher levels of emissions output for CO and HC when the ambient conditions approximated hot day sea level conditions while producing slightly lower levels of nitrogen oxides. Author

N80-17071*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AERODYNAMIC PERFORMANCES OF THREE FAN STATOR DESIGNS OPERATING WITH ROTOR HAVING TIP SPEED OF 337 METERS PER SECOND AND PRESSURE RATIO OF 1.54. 1: EXPERIMENTAL PERFORMANCE

Thomas F. Gelder Feb. 1980 108 p refs
(NASA-TP-1610; E-136) Avail: NTIS HC A06/MF A01 CSCL 21E

The aerodynamic performances of four stator-blade rows are presented and evaluated. The aerodynamic designs of two of these stators were compromised to reduce noise, a third design was not. On a calculated operating line passing through the design point pressure ratio, the best stator had overall pressure-ratio and efficiency decrements of 0.031 and 0.044, respectively, providing a stage pressure ratio of 1.483 and efficiency of 0.865. The other stators showed some correctable deficiencies due partly to the design compromises for noise. In the end-wall regions blade-element losses were significantly less for the shortest chord studied. Author

N80-17072# Volvo Flygmotor A.B., Trollhaettan (Sweden).

EFFECTS OF DESIGN PARAMETERS ON COOLING AIR REQUIREMENT IN A GAS TURBINE COMBUSTOR

Bjorn G. A. Sjoblom 22 Aug. 1979 34 p refs Backup document for AIAA synoptic scheduled for publication in Journal of Aircraft on May 1980
(Log-C3797) Avail: NTIS HC A02/MF A01

A computer program for the preliminary design of aircraft gas turbine combustors was used for a parametric study. The program is based on established methods for wall temperature calculations and it determines the main dimensions, the air flow distribution and the film cooling air requirement. Effects of design parameters on the cooling air flow in an aircraft gas turbine combuster were studied. Variation of the overall pressure ratio gave a similar trend as data for existing combustors. It was also found that the percentage of cooling air for a typical design is roughly proportional to the overall pressure ratio to the 0.85 power multiplied by the turbine inlet temperature to the 2.4 power TIT 2.4, which provides a simple extrapolation formula for existing combustors. Author

N80-17073*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla.

DISTRIBUTION ANALYSIS FOR F100(3) ENGINE Final Report

W. A. Walter and M. Shaw Jan. 1980 66 p refs
(Contract NAS3-20835)
(NASA-CR-159754; FR-12087) Avail: NTIS HC A04/MF A01 CSCL 21E

The F100(3) compression system response to inlet circumferential distortion was investigated using an analytical compressor flow model. Compression system response to several types of distortion, including pressure, temperature, and combined pressure/temperature distortions, was investigated. The predicted response trends were used in planning future F100(3) distortion tests. Results show that compression system response to combined temperature and pressure distortions depends upon the relative orientation, as well as the individual amplitudes and circumferential extents of the distortions. Also the usefulness of the analytical predictions in planning engine distortion tests is indicated. J.M.S.

N80-17074*# Pratt and Whitney Aircraft, East Hartford, Conn.
EXPERIMENTAL EVALUATION OF A LOW EMISSIONS HIGH PERFORMANCE DUCT BURNER FOR VARIABLE CYCLE ENGINES (VCE) Final Report
R. P. Lohmann and R. J. Mador Oct. 1979 118 p refs
(Contract NAS3-20602)
(NASA-CR-159694; PWA-5513-32A) Avail: NTIS HC A06/MF A01 CSCL 21A

An evaluation was conducted with a three stage Vorbix duct burner to determine the performance and emissions characteristics of the concept and to refine the configuration to provide acceptable durability and operational characteristics for its use in the variable cycle engine (VCE) testbed program. The tests were conducted at representative takeoff, transonic climb, and supersonic cruise inlet conditions for the VSCE-502B study engine. The test stand, the emissions sampling and analysis equipment, and the supporting flow visualization rigs are described. The performance parameters including the fuel-air ratio, the combustion efficiency/exit temperature, thrust efficiency, and gaseous emissions calculations are defined. The test procedures are reviewed and the results are discussed. A.W.H.

N80-17075# Massachusetts Inst. of Tech., Cambridge. Gas Turbine and Plasma Dynamics Lab.
BOUNDARY LAYER AND WAKE MODIFICATIONS TO COMPRESSOR DESIGN SYSTEMS: THE EFFECT OF BLADE-TO-BLADE FLOW VARIATIONS ON THE MEAN FLOW FIELD OF A TRANSONIC ROTOR Final Report, 1 Sep. 1976 - 31 Aug. 1978
Arun K. Sehra Wright-Patterson AFB, Ohio AFAPL Mar. 1979 218 p refs
(Contract F33615-76-C-2118; AF Proj. 2307)
(AD-A076204; GT/PDL-144; AFAPL-TR-79-2010) Avail: NTIS HC A10/MF A01 CSCL 21/5

The effect of blade-to-blade flow variations on the mean flow field of a highly loaded transonic axial flow compressor was investigated. The theoretical approach centered around modeling of three important phenomena associated with blade-to-blade flow fluctuations, which control the mean momentum and energy transfer processes. Apparent stresses were introduced into the mean flow momentum equations by pitchwise averaging. Loss concept of mean relative total pressure, due to conversion of mean flow kinetic energy to the energy of fluctuations, was introduced. Based on this concept, mean rothalpy and the production of apparent entropy were defined. An expression for mean rothalpy variation along the streamline was derived by pitchwise averaging of the energy equation. Mean flow equations suitable for the streamline curvature computational scheme were developed which include these three effects. Apparent stresses, mean rothalpy and apparent entropy variations were calculated from measured velocity fluctuations. The revised streamline curvature procedure was then used to predict the axisymmetric (peripheral mean) flow. The agreement of rotor outlet tangential velocity is excellent, reproducing an unusual peak which is not explainable by usual techniques. The results showed that 3-D inviscid effects do not significantly modify the mean flow, and that the direct effect of apparent stresses on the mean flow is also small. GRA

N80-17076# Dayton Univ., Ohio.
PROBE EFFECTS IN GAS TURBINE COMBUSTOR EMISSION MEASUREMENTS Final Report, 1 Mar. - 1 Oct. 1978
J. A. Clark, J. E. Peters, and A. M. Mellor Jun. 1979 62 p refs Prepared in cooperation with Purdue Univ., Lafayette, Ind., Combustion Lab.
(Contract F33615-77-C-2069; AF Proj. 2308)
(AD-A076257; AFAPL-TR-79-2041; PUDU-CL-78-05) Avail: NTIS HC A04/MF A01 CSCL 21/5

Four geometrically distinct, stainless steel probes are used to study the concentrations of CO, HC, NO, and NOX at several different radial and two different axial positions within a simplified gas turbine combustor. The probes are all water cooled but do not employ an aerodynamic quench. They are designed to assess the effect of tip shape, tip to body proximity, and probe entry point on measured pollutant concentrations. Though probe entry point and tip to body proximity are shown to imperceptibly affect the pollutant concentrations, probe tip geometry has a marked impact on the measured pollutant levels. Specifically, the aerodynamic, tapered-tip probe yields depressed CO and HC, and elevated NO concentrations compared to other three blunt-tipped probes. Regarding reproducibility, the pollutant concentrations measured with one of the blunt-tipped probes in this study are compared to pollutant levels measured with the same probe three years ago (Tuttle, et al. 1975). CO and HC are shown to be the most reproducible species, while NO and NOx acceptably but less accurately agree with past studies.GRA

N80-17077# Aeronautical Research Council, London (England).
VORTEX SHEDDING MECHANISMS IN RELATION TO TIP CLEARANCE FLOWS AND LOSSES IN AXIAL FANS
R. I. Lewis (Newcastle Univ. Engl.) and E. C. H. Yeung (Newcastle Univ. Engl.) London HMSO May 1977 37 p refs Supersedes ARC-37359
(ARC-R/M-3829; ISBN-0-11-471162-3; ARC-37359) Avail: NTIS HC A03/MF A01; HMSO £4.00; PHI

The importance of tip leakage flows in axial fans as a source of loss is evaluated. The dimensionless loss is related to a range of dimensionless parameters by application of a jet loss theory. Vortex shedding models are presented. Theoretical predictions of lift coefficient reduction are compared with published experimental data for isolated rectangular plates, with experimental tests for a single airfoil adjacent to a wall with an oncoming boundary layer, and with correlations of the percentage reduction in total lift versus gap chord ratio. Author (ESA)

N80-17078# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Stabsabt. Programmvorbereitung.
TURBINE ENGINE RESEARCH AND TECHNOLOGY IN THE FEDERAL REPUBLIC OF GERMANY, VOLUME 1
Alf Loeffler Dec. 1978 188 p refs In GERMAN; ENGLISH summary 2 Vol.
(DFVLR-Mitt-78-04) Avail: NTIS HC A09/MF A01; DFVLR, cologne DM 54,20

The economic importance of the technology of gas turbines, steam turbines, turbosuperchargers, and turbocompressors is cited relative to German industry and its share of the world market. The priorities for research and development are derived from the mission requirements of these engines. An extensive inquiry by questionaire and discussions with experts provided the foundation for a description of the current technological status and expected trends in this field. In addition, they served as a basis for the evaluation of a possible technological transfer. Conclusions are drawn with respect to the importance of technological progress for national economy, development of transportaion technology, defense technology, and energy economy. Author (ESA)

N80-17079# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Stabsabt. Programmvorbereitung.
TURBINE ENGINE RESEARCH AND TECHNOLOGY IN THE FEDERAL REPUBLIC OF GERMANY, VOLUME 2
Alf Loeffler Dec. 1978 167 p refs In GERMAN; ENGLISH summary 2 Vol.
(DFVLR-Mitt-78-05) Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 51,40

The economic importance of the technology of gas turbines, steam turbines, turbosuperchargers, and turbocompressors is cited relative to German industry and its share of the world market. The priorities for research and development are derived from the mission requirements of those engines. An extensive inquiry by questionnaire and discussions with experts provided the foundation for a description of the current technological status and expected trends in this field. In addition they served as a basis for the evaluation of a possible technological transfer. Conclusions are drawn with respect to the importance of technological progress for national economy development of transportation technology, defense technology, and energy economy. Author (ESA)

N80-17263 Air Force Materials Lab., Wright-Patterson AFB, Ohio.
VIBRATIONS OF A COMPRESSOR BLADE WITH SLIP AT THE ROOT
David I. G. Jones and Agnieszka Muszynska (Polish Academy of Sciences, Warsaw) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 53-61 (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington D.C.

N80-17265 Sikorsky Aircraft, Stratford, Conn.
DAMPING OF AN ENGINE EXHAUST STACK
John J. DeFelice and Ahid D. Nashif (Anatrol Corp., Cincinnati, Ohio) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 75-84 (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington D.C.

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-17080# SRI International Corp., Menlo Park, Calif.
PILOTED FLIGHT SIMULATION STUDY OF LOW-LEVEL WIND SHEAR, PHASE 4. ALL-WEATHER LANDING SYSTEMS, ENGINEERING SERVICES SUPPORT PROJECT, TASK 2 Interim Report, Apr. 1978 - Mar. 1979
W. H. Foy and W. B. Gartner Mar. 1979 148 p refs
(Contract DOT-FA75WA-3650; SRI Proj. 4364)
(AD-A077164; FAA-RD-79-84) Avail: NTIS HC A07/MF A01 CSCL 01/2

The fourth in a series of piloted DC10 flight simulation exercises concerned with the development and test of airborne techniques designed to aid the pilot in detecting and coping with low level wind shear are described. The exercise included validation tests of systems developed from the techniques that had shown the most promise in previous tests. Approach and landing situations were simulated, using manual control assisted by flight director. Takeoff trials were run against 5 wind profiles by the 3 project pilots. No good airborne means of coping with wind shear were found. R.C.T.

N80-17081*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLIGHT TESTS OF THE TOTAL AUTOMATIC FLIGHT CONTROL SYSTEM (TAFCOS) CONCEPT ON A DHC-6 TWIN OTTER AIRCRAFT
William R. Wehrend, Jr. and George Meyer Feb. 1980 73 p refs
(NASA-TP-1513; A-7901) Avail: NTIS HC A04/MF A01 CSCL 01C

Flight control systems capable of handling the complex operational requirements of the STOL and VTOL aircraft designs as well as designs using active control concepts are considered. Emphasis is placed on the total automatic flight control system (TACOS) (TAFCOS). Flight test results which verified the performance of the system concept are presented. J.M.S.

N80-17082# Honeywell Systems and Research Center, Minneapolis, Minn.
DIGITAL FLIGHT CONTROL SOFTWARE VALIDATION STUDY Final Report, Apr. 1978 - Apr. 1979
Edward R. Rang, Michael J. Gutmann, Dennis B. Mulcare, and William G. Ness Wright-Patterson AFB AFFDL Jun. 1979 257 p refs
(Contract F33615-78-C-3605)
(AD-A076021; HONEYWELL-79SRC18; AFFDL-TR-79-3076) Avail: NTIS HC A12/MF A01 CSCL 01/3

The problems of designing, verifying, and validating software for digital flight control systems are reviewed to study how the new software engineering tools and techniques may be incorporated into the development process. This shows how automated methodologies will provide error-free flight control software at lower costs. The need for expensive, lengthy test programs is reduced by analytical methods. The quality of the software is demonstrated with higher confidence when designs are structured to facilitate the subsequent verification steps. The military standards relating to flight control systems are reviewed, and modifications to include provisions for software verification are recommended. GRA

N80-17083# National Aeronautical Establishment, Ottawa (Ontario).
THEORETICAL ANALYSIS OF THE TRANSIENT RESPONSE OF A WING TO NON-STATIONARY BUFFET LOADS
B. H. K. Lee Apr. 1979 86 p refs
(AD-A073702; NAE-LR-597; NRC-17465) Avail: NTIS HC A05/MF A01 CSCL 20/4

A method for predicting the response of a wing to non-stationary buffet loads is presented. The wing is treated as a cantilever beam with known mass distribution. Using generalized co-ordinates, the vibration of the wing is governed by the second order mass-spring-damper oscillator equation. The buffet load on the wing is expressed as an integral of the sectional force, which is a function of the spanwise location and time. The non-stationary load is represented by the product of a deterministic time function and a statistically stationary random function. The time history of the applied load is segmented into a number of time intervals. Analytical expressions for the mean square response of the wing displacement are derived using a power spectral density for the random part of the applied load, similar to that used in the theory of isotropic turbulence. The effects of damping, ratio of the undamped natural frequency of the system to the half power frequency of the power spectral density, length of time segment, and duration of applied load on the response of the wing have been investigated for three examples of the load versus time histories. (GRA)

N80-17084# Universite des Sciences et Techniques de Lille (France).
INITIAL STUDY OF THE RESPONSE OF AN AIRCRAFT TO LATERAL GUSTS [RESPONSE DE L'AVION AUX RAFALES LATERALES. ETUDES EXPLORATOIRE]
J. L. Cocquerez and R. A. Verbrugge Paris Assoc. Aeron. et Astronautique de France 1979 37 p In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-03) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 29 (France and EEC) FF 33 (others)

The study of aircraft performance in turbulence, especially the response to lateral gusts, is required in order to optimize the use of automatic flight control systems. Those flight conditions emphasized include low altitude approach, landing with wind composed of transversal gusts, and stability at steep angles of attack at low speeds. The preponderant effects of gust loads vis-a-vis degrees of freedom, the roles of the various control surfaces of the aircraft, and the responses of different aircraft planforms are shown, leading to the modelization of these phenomena. Author (ESA)

N80-17085# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
THE IDENTIFICATION OF THE FLUTTER MECHANISM FROM A LARGE-ORDER FLUTTER CALCULATION
J. C. A. Baldock London HMSO Feb. 1978 48 p refs
Supersedes RAE-TR-78017 and ARC-37871
(ARC-R/M-3832; ISBN-0-11-47116-8; RAE-TR-78017; ARC-37871) Avail: NTIS HC A03/MF A01; HMSO £5.00; PHI

The phase differences between degrees of freedom in a flutter calculation are discussed. From the study of phase variation with airspeed in binary systems, a technique is evolved for identifying the essential degrees of freedom in a large-order flutter calculation. This technique can be combined with a general flutter analysis in order to represent the flutter condition in a large-order flutter calculation with an equivalent two degree of freedom system. Author (ESA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N80-17086# Illinois Univ., Urbana. Dept. of Civil Engineering.
LONGITUDINAL JOINT SYSTEMS IN SLIP-FORMED RIGID PAVEMENTS. VOLUME 2: ANALYSIS OF LOAD TRANSFER SYSTEMS FOR CONCRETE PAVEMENTS Interim Report
R. M. Tabatabaie, E. J. Barenberg, and R. E. Smith Nov. 1979 192 p refs
(Contract DOT-FH-11-8474)
(AD-A078836; FAA-RD-79-4-2) Avail: NTIS HC A09/MF A01 CSCL 13/2

The theoretical evaluation of alternate joint systems are discussed. The findings and conclusions plus recommendations for implementation are given. Models are presented which form the basis for significantly improved design procedures for rigid pavements. These models and analysis techniques provide the tools for the design and analysis for various pavement systems with both longitudinal and transverse joint systems. R.C.T.

N80-17087# Vehicle Systems Development Corp., Upland, Calif.
DETAILED DESIGN AND FABRICATION OF A HELICOPTER GROUND MOBILITY SYSTEM (HGMS) Final Technical Report, Oct. 1977 - May 1979
Robert W. Forsyth, John P. Forsyth, Nathan N. Shiovitz, and Laurence E. Reinhart Sep. 1979 47 p refs
(Contract DAAJ02-77-C-0077)
(AD-A076932; VSDC-579/43; USARTL-TR-79-24) Avail: NTIS HC A03/MF A01 CSCL 01/3

This report presents the results of a program for the design, fabrication, test, and demonstration of two identical engineering models of the Helicopter Ground Mobility System (HGMS). Task 1 resulted in a complete, detailed and documented design for the HGMS prime mover, skid-equipped helicopter adapter, and flotation track assemblies. In Task 2, the design was converted into hardware which, along with a device simulating the wheel-equipped UH-60A (Black Hawk) and YAH-64 (AAH) helicopters, was tested in Task 3 to demonstrate compliance with the requirement and specification for the HGMS. Minor changes, the need for which emerged from the test activity, were incorporated in the engineering models and design data during Task 3. In Task 4, the contractor prepared assessments of HGMS reliability and maintainability as well as estimates of requirements for logistics support. The total program described in this final report produced systems which clearly indicate that Army helicopters, both wheeled and skid-equipped, can be successfully transported between a forward area landing zone and a concealed larger area with no surface preparation and with a minimum of equipment and personnel. Moreover, the program demonstrated that a lightweight and helicopter-transportable HGMS answers the Army's long-standing need for helicopter ground mobility. GRA

N80-17088# ARO, Inc., Arnold Air Force Station, Tenn.
EXPERIMENTS FOR THE REDUCTION OF WIND TUNNEL WALL INTERFERENCE BY ADAPTIVE-WALL TECHNOLOGY Final Report, Oct. 1977 - Sep. 1978
E. M. Kraft and R. L. Parker, Jr. AEDC, Arnold AFS, Tenn. Oct. 1979 43 p refs
(AD-A076555; AEDC-TR-79-51) Avail: NTIS HC A03/MF A01 CSCL 20/4

Experiments were conducted in the AEDC Aerodynamic Wind Tunnel (1T) to evaluate the applicability of adaptive-wall technology to reduce wall interference in a transonic wind tunnel. Data were obtained on a six-percent-blockage, two-dimensional, NACA 0012 airfoil section with two different, adaptable porous wall configurations. One configuration featured variable longitudinal control of the local hole angle and the other featured global porosity control. The experiments demonstrated that adaptive-wall techniques could be used to significantly reduce wall interference effects. Although neither wall configuration could be adjusted to duplicate the pressure distributions (calculated at the tunnel boundary control surface with adaptive-wall technology) to produce interference-free conditions, matching the pressure level upstream of the model and minimum pressure in the vicinity of the model adequately reduced the wall interference. One of the most effective means for matching these global parameters was plenum pressure adjustment; thus, some refinement may be obtained through segmented plena control. GRA

N80-17089# Civil Aeronautics Board, Washington, D.C.
AIRPORT ACTIVITY STATISTICS OF CERTIFICATED ROUTE AIR CARRIERS Semiannual Report
31 Dec. 1978 315 p Prepared in cooperation with FAA, Washington, D.C.
(AD-A076194) Avail: NTIS HC A14/MF A01 CSCL 01/2

This report furnishes airport activity of the Certificated Route Air Carriers. Included in the data contained in table 6 are passenger enplanements, tons of enplaned freight, express, and mail. Both scheduled and non-scheduled service, and domestic and international operations are included. These data are shown by airport and carrier. Table 7 includes departures by airport, carrier and type of operation, and type of aircraft. GRA

N80-17090# Boeing Co., Wichita, Kans.
JET ENGINE DEMOUNTABLE TEST CELL EXHAUST SYSTEM PHASE: COANDA/REFRACTION NOISE SUPPRESSION CONCEPT, ADVANCED DEVELOPMENT
R. E. Ballard, W. F. Byers, and D. L. Armstrong Apr. 1979 91 p refs
(Contract N00014-76-C-1229)
(AD-A076253; D3-11527-1; NAEC-92-112) Avail: NTIS HC A05/MF A01 CSCL 01/5

The successfully demonstrated Coanda/refraction air-cooled exhaust noise suppressor system is applied to the Navy requirement for effective exhaust noise suppression in jet engine demountable test cells. The technical approach consists of analytical studies and one-sixth scale model tests using simulated afterburning engine exhaust. Revisions are made to the previously developed system to improve noise suppression capability while reducing the system overall size and initial cost. Revisions include moving secondary air inlets to reduce enclosure size and improve cooling, shortening the Coanda surface to provide more acoustically treated exhaust stack and providing variations in exhaust stack configuration such as single and dual acoustic splitters and acoustic wedges up the back wall. Extensive data were recorded and analyzed to identify the aerothermodynamic and acoustic trends related to these configuration changes. Results present recommendations for an air-cooled Coanda/refraction exhaust system for application to demountable test cells. GRA

N80-17091# Boeing Co., Wichita, Kans.
JET ENGINE CLASS C TEST CELL EXHAUST SYSTEM PHASE. COANDA/REFRACTION NOISE SUPPRESSION CONCEPT-ADVANCED DEVELOPMENT Technical Report, Oct. 1976 - Jan. 1977
R. E. Ballard and D. L. Armstrong Lakehurst, N.J. Naval Air Engineering Center May 1979 89 p refs
(Contract N00140-76-C-1229)
(AD-A075277; D3-11500-1; NAEC-92-113) Avail: NTIS HC A05/MF A01 CSCL 20/1

The successfully demonstrated Coanda/refraction air-cooled exhaust noise suppressor system is applied to the Navy requirement for an effective air-cooled retrofit configuration for the class 'C' test cells (concrete enclosure). The technical approach consists of analytically sizing retrofit components to meet both acoustic and aerothermodynamic requirements and then testing at one-sixth scale using simulated afterburning engine exhaust to verify the design configuration. Model variations included exhaust stack height, exhaust stack inner flow passage configurations (straight walls and diffuser) and removal of a concrete internal partition wall. Extensive data were recorded and analyzed to identify the aerothermodynamic trends related to these configuration changes. Results present recommendations for an air-cooled Coanda exhaust noise suppression system for retrofit of Navy class 'C' test cells. GRA

N80-17092# National Aeronautical Establishment, Ottawa (Ontario).
A PERTURBATION THEORY OF TWO-DIMENSIONAL TRANSONIC WIND TUNNEL WALL INTERFERENCE
Y. Y. Chan Apr. 1979 27 p refs
(AD-A071167; NAE-LR-598; NRC-17476) Avail: NTIS HC A03/MF A01 CSCL 20/4

The wind tunnel wall interference in transonic speed is formulated as perturbation to the basic flow around the airfoil in free air. The perturbation equation is derived from the transonic small disturbance equation and is linear but with variable coefficients containing the non-linear solution of the basic flow. The equation is solved numerically by a direct matrix method using the classical boundary condition for a porous wall. The solution in terms of lift versus angle of attack agrees well with that calculated directly from the small disturbance equation. GRA

N80-17093# Royal Aircraft Establishment, Bedford (England). Structures Dept.
THE REDUCTION OF DYNAMIC INTERFERENCE BY SOUND-ABSORBING WALLS IN THE RAE 3 FOOT WIND TUNNEL
D. G. Mabey London AMSO Aug. 1977 40 p refs Supersedes RAE-TR-77120 and ARC-37618
(ARC-R/M-3837; BR69024; ISBN-0-11-471170-4; RAE-TR-77120; ARC-37618) Avail: NTIS HC A03/MF A01; HMSO £ 5.00; PHI

A preliminary investigation made with temporatory test liners in a 3-ft by 3-ft tunnel confirms that there are significant advantages in using working sections with sound-absorbing walls for aeroelastic tests at subsonic and transonic speeds. In particular, tunnel resonances and flow unsteadiness can be reduced just as effectively in a large wind tunnel as in the small tunnel (4-in by 4-in) used for previous pilot tests. The reduction in flow unsteadiness obtained with sound-absorbing walls significantly improved wind buffeting measurements on an ordinary wind tunnel model. Author (ESA)

N80-17094# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
THE INFLUENCE OF SIMULATOR MOTION WASH-OUT FILTERS ON THE PERFORMANCE OF PILOTS WHEN STABILIZING AIRCRAFT ATTITUDE IN TURBULENCE
M. F. C. VanGool 1 Feb. 1978 52 p refs
(NLR-TR-78022-U) Avail: NTIS HC A04/MF A01

The influence of simulator motion on the performance of four pilots when stabilizing an aircraft disturbed by turbulence in the pitch and roll axes was investigated. Pilot describing functions, remnant spectra, and a number of associated performance measures were determined for this compensatory tracking task. The results lead to the conclusion that for the task under consideration, no significant differences can be observed when the second-order high-pass wash-out filter break frequency in the pitch and roll degree of freedom is varied from 0.1 rad/sec to 0.5 rad/sec. However, performance in either condition is considerably better than results obtained fixed-based. This is also reflected in the pilot comments and effort ratings, stating that the task is easier with motion. Author (ESA)

N80-17095# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
WIND TUNNELS AND TEST RIGS
P. Braushaw Jul. 1979 6 p Supersedes IC-Aero-70-01
(IC-Aero-79-05; ISSN-0308-7247; IC-Aero-70-01) Avail: NTIS HC A02/MF A01

Dimensions and details are given for 14 test rigs, ranging from a water channel to a Mach 25 nitrogen tunnel. Data, in tabular form, is divided into three sections: low speed tunnels, high speed tunnels, and water test rigs. Summaries of operating conditions as well as remarks on special applications are included. Author (ESA)

N80-17096# Royal Aircraft Establishment, Bedford (England). Structures Dept.
THE USE OF SOUND ABSORBING WALLS TO REDUCE DYNAMIC INTERFERENCE IN WIND TUNNELS
D. G. Mabey London HMSO Nov. 1976 74 p refs Supersedes RAE-TR-76157 and ARC-37436
(ARC-R/M-3831; ISBN-0-114-71164; RAE-TR-7615; ARC-37436) Avail: NTIS HC A04/MF A01; HMSO £7.00; PHI

A scheme for reducing dynamic interference in wind tunnel at subsonic and transonic speeds was tested in a pilot 4in x 4in tunnel. Two types of dynamic interference were considered: excitation of unwanted acoustic resonances within the working section and flow unsteadiness. The models used to establish the resonances in the working sections with hard walls were small circular cylinders operating in a subcritical Reynolds number range and thus generating discrete pressure fluctuations at the vortex shedding frequency. When the resonances were suppressed by the wall materials the pressure fluctuations agreed well with previous measurements made in a much larger, low speed wind tunnel and with predictions. The tests show that both types of interferences could be substantially reduced by replacing the conventional hard walls of a closed or a slotted working section by appropriate sound absorbing walls. Author (ESA)

N80-17271 SRI International Corp., Menlo Park, Calif.
FINITE ELEMENT ANALYSIS OF MULTICOMPONENT STRUCTURES IN RIGID BARRIER IMPACTS
J. K. Gran, L. E. Schwer, J. D. Colton, and H. E. Lindberg *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 153-160 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N80-17097 Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
THE 1979 JANNAF PROPULSION MEETING, VOLUME 1
Karen L. Strange, ed. Mar. 1979 643 p Meeting held at Anaheim, Calif., 6-8 Mar. 1979
(Contract N00024-78-C-5384)
(AD-A075262; CPIA-Pub-300-Vol-1) Avail: Issuing Activity CSCL 22/1

A collection of papers dealing with various aspects of ballistics missile propulsion is presented. Topics discussed include research, development, test, and engineering advancements in solid, liquid, ramjet, and gun propulsion systems. For individual titles, see N80-17098 through N80-17119.

N80-17098 Thiokol Corp., Elkton, Md.
MX CANISTER EJECT GAS GENERATOR c20
Donald R. Reed, E. Lynn Thomas, Joseph E. Reardon, and Winthrop L. Cummings (Westinghouse Elec. Corp., Sunnyvale) *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 1-24 (For primary document see N80-17097 08-12)
(Contract F04704-75-C-0010)
Avail: Issuing Activity

Hot gas generator eject system studies and tests were conducted in support of the overall MX canister program. A hot gas generator was designed to pressurize the canister breech and eject the missile with specific axial dynamics. The resulting MX launch eject gas generator design was fabricated and statically tested to evaluate its high mass flow, high progressivity, and short burn characteristics. The same basic generator design and many components were then adapted to produce MX peashooter eject gas generators. MX peashooter launch tests successfully demonstrated the launch technique and produced energy loss information useful for more accurate prediction of eject system performance. R.E.S.

N80-17099 Martin Marietta Corp., Denver, Colo.
MX BREAKOUT AND ERECTION SYSTEM DEVELOPMENT c15
Loman T. Park *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 25-62 (For primary document see N80-17097 08-12)
(Contract F04704-77-C-0008)

Avail: Issuing Activity

The analysis, design, and development effort leading to the full scale demonstration testing of the MX missile breakout and erection system is presented with emphasis on the actuators and gas generators. R.E.S.

N80-17100 Vought Corp., Dallas, Tex.

ALVRJ FLIGHT TEST PROGRAM SUMMARY c15

L. E. Pearson *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 63-82 (For primary document see N80-17097 08-12)

Avail: Issuing Activity

An advanced development flight test program of the Navy's air launched low volume ramjet (ALVRJ) was completed in 1976. The program resulted in five highly successful flight tests of an integral rocket ramjet (IRR) missile configuration through various simulated tactical flight profiles. The program successfully demonstrated IRR technology, established the performance capability of the ALVRJ configuration and provided environmental data operating in this high temperature, high dynamic pressure sustained flight regime. The flight test program is discussed including preparations and conduct of the tests, flight characteristics of the vehicle, performance math model simulation used for flight predictions, and data analysis techniques and routines used to define the performance capability of the subsystems as well as the total vehicle system. R.E.S.

N80-17101 Aerojet Solid Propulsion Co., Sacramento, Calif.

THE EFFECT OF PROPELLANT FORMULATION VARIABLES ON COMBUSTION STABILITY c28

G. A. Zimmerman and M. J. Ditore *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 83-99 refs (For primary document see N80-17097 08-12)

Avail: Issuing Activity

The combustion stability results obtained during reduced smoke propellant development are reviewed and the effects of propellant formulation variables on pressure coupled combustion response, as obtained from T-burner tests, are presented. The data relate the effect of AP particle size, stability additive type, concentration, and particle size on combustion response. For some of the variables, the effects of frequency and pressure are shown. The laboratory burner tests correlated well with motor test firings. Author

N80-17102 Thiokol Corp., Huntsville, Ala. Huntsville Div.

EFFECTS OF FORMULATION VARIABLES ON THE COMBUSTION STABILITY CHARACTERISTICS OF SOME REDUCED SMOKE PROPELLANT c28

R. B. Kruse and D. W. Booth *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 99-118 ref (For primary document see N80-17097 08-12)

Avail: Issuing Activity

Three groups of reduced-smoke propellants were tested to evaluate the effects of formulation variables upon processing characteristics, tensile properties, burning rate, burning rate exponent, and nonsteady combustion behavior. The combustion stability characteristics of the propellants were considered along with a greatly simplified T-burner test procedure employed as a screening tool to rank a large number of propellants in at least a semi-quantitative fashion. The effects of such variables as oxidizer particle size distribution and incorporation of additives intended to enhance burning rate or stability characteristics upon the combustion response of the propellant are discussed. M.M.M.

N80-17103 Aerojet Solid Propulsion Co., Sacramento, Calif.

EQUILIBRIUM MODEL FOR SECONDARY SMOKE PREDICTION c28

James P. Coughlin *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 119-133 refs (For primary document see N80-17097 08-12)

Avail: Issuing Activity

Correlation of equilibrium model predictions with measured secondary smoke in flight tests conducted at Eglin Air Force Base indicated an 87.5% prediction accuracy for both a double base minimum smoke propellant and a composite AP reduced smoke propellant. Also included in the correlation was an earlier series of ground launched flight tests with a rocket containing another composite AP propellant. Required input for the analysis and predictions includes chemical composition of the propellant, altitude, temperature and relative humidity of the ambient air, motor chamber pressure and nozzle dimensions, and missile velocity. M.M.M.

N80-17104 Army Missile Research and Development Command, Redstone Arsenal, Ala.

COMPARISON OF FLUORINE AND CHLORINE CONTAINING COMPOUNDS ON SECONDARY SMOKE FORMATION c28

M. T. Cucksee and H. C. Allen *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 135-143 (For primary document see N80-17097 08-12)

Avail: Issuing Activity

A series of propellants was designed to determine and compare effects of chlorine and fluorine, with and without heavy metals, on secondary smoke formation. It was concluded that secondary smoke formation by fluorine containing compounds does not appear to be a serious obstacle to their use in minimum smoke propellants. M.M.M.

N80-17105 Brunswick Corp., Lincoln, Nebr.

DEVELOPMENT OF A COMPOSITE MOTOR CASE FOR THE VIPER ANTITANK WEAPON SYSTEM c20

A. R. Cederberg *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 145-157 (For primary document see N80-17097 08-12)

(Contract DAAH01-76-C-0658)

Avail: Issuing Activity

A filament wound fiberglass/epoxy composite motor case was successfully developed for the VIPER tactical weapon system. This motor case can be mass produced at low cost while maintaining high reliability. Significant advances in the state of the art of filament winding and the design of filament wound components are provided along with the development of an improved structural joint technology for composite materials utilizing mechanical fasteners. Implementation of these concepts was accomplished through development of high speed numerically controled winding equipment and supporting computer software. M.M.M.

N80-17106 Boeing Aerospace Co., Huntsville, Ala. Army Systems Div.

ROCKET MOTOR PEAK NOISE REDUCTION PROGRAM c20

Charles R. Carter *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 159-185 refs (For primary document see N80-17097 08-12)

(Contract DAAK40-78-C-0038)

Avail: Issuing Activity

The design, test and analysis of two techniques being developed for reducing the peak noise produced by a shoulder-fired rocket weapon system are described. Tests verified that the peak noise produced by the M-72 rocket motor can be reduced at the gunner's position by 10 db with a baffled cylinder suppressor and by 1.3 db by aerodynamically shaping the nozzle closure. Analysis of the unsuppressed and suppressed peak noise generated by the M-72 rocket motor indicate that the peak noise in the near field is produced by the energy associated with a strong pressure wave that can be correlated with spherically symmetric point explosion data. The hardware test data base and analysis techniques developed provided a basis for the design of prototype field weight suppressor systems for protecting the gunner and crew from the intense peak noise produced by both man-portable and shoulder-fired rocket weapon systems. M.M.M.

N80-17107 Massachusetts Inst. of Tech., Cambridge. Francis Bitter National Magnet Lab.

ELECTROMAGNETIC GUNS, LAUNCHERS AND REACTION ENGINES c14

Henry H. Kolm *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 329-346 refs (For primary document see N80-17097 08-12)

(Grant DAAG29-78-G-0147)

Avail: Issuing Activity

Electromagnetic acceleration is studied as an alternative to chemical propulsion. Systems considered include the dc rail gun driven by energy stored inertially in a homopolar generator and transmitted through a switching inductor, and the synchronous mass driver energized by a high voltage alternator through an oscillating coil-capacitor circuit. A momentum transformer that transfers momentum from a massive, chemically propelled armature sabot to a much lighter, higher velocity projectile by magnetic flux compression is described. Among the potential applications are the acceleration of gram-size particles, terminal ballistic and impact fusion research, low powered STOL aircraft, and the launching of small space vehicles at high repetition rates. K.L.

N80-17108 Army Armament Research and Development Command, Dover, N. J.

CONTROLLING STOCKPILED PROPELLANT c20

Gayton Silvestro *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 347-358 refs (For primary document see N80-17097 08-12)

Avail: Issuing Activity

A program for evaluating the safety and performance of propellants stored in packs, building structures, and under various conditions of temperature and humidity is described. Laboratory tests include stabilizer content, heat stability, total volatiles, and closed bomb. Ballistic tests include charge establishment and uniformity. K.L.

N80-17109* Thiokol Corp., Brigham City, Utah. Wasatch Div.

SPACE SHUTTLE SRM DEVELOPMENT c16

I. C. Adams and F. W. Call *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 405-436 (For primary document see N80-17097 08-12)

(Contract NAS8-30490)

Avail: Issuing Activity CSCL 22B

The successful static testing of the fourth Space Shuttle Solid Rocket Motor (SRM) is described. Transportation and support equipment concepts and component reusability are demonstrated. The evolution of the SRM transportation support equipment and special test equipment designs are reviewed, and development activities are discussed. Handling and processing aspects of large, heavy components are reviewed briefly. K.L.

N80-17110* Rockwell International Corp., Downey, Calif. Space Systems Group.

IMPROVING PERFORMANCE OF THE SPACE SHUTTLE c16

D. L. Gerhardt and N. A. Bremberg *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 437-445 (For primary document see N80-17097 08-12)

(Contract NAS9-1400)

Avail: Issuing Activity CSCL 22B

The use of strap-on solids on either the solid rocket boosters or the external tank was studied. Relative feasibilities were defined and long range growth potentials were determined. K.L.

N80-17111 ARO, Inc., Arnold Air Force Station, Tenn. AEDC Div.

FACILITY REQUIREMENTS FOR IUS SOLID-PROPELLANT ROCKET MOTOR TESTING c20

F. D. Cantrell and C. H. Kunz *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 447-457 refs (For primary document see N80-17097 08-12)

Avail: Issuing Activity CSCL 21H

The test facility requirements for the development and qualification testing of the Inertial Upper Stage (IUS) solid propellant rocket motors at simulated altitude conditions are reviewed. These requirements are: (1) maintain an environmental pressure such that nozzles with large area ratios will flow full throughout motor burn; (2) capture the exhaust gases from fixed nozzles and nozzles equipped with extendible exit cones gimbaling at large angles; (3) provide simulated altitude environment for motors ranging in thrust levels from 10,000 to 60,000 lbf with burn times up to 160 sec; (4) accurately determine ballistic performance; (5) temperature condition and test motors between 23 and 102 F; (6) temperature condition nozzle exit cones to -150 F before motor ignition; and (7) spin test motors with gross weights of 8,000 lbm and 25,000 lbf thrust at spin rates of 70 rpm. K.L.

N80-17112*# Vought Corp., Dallas, Tex.

AGING PROBLEMS IN GRAPHITE PHENOLIC NOZZLE LINERS c20

G. S. McCorkle *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 461-472 ref (For primary document see N80-17097 08-12)

(Contract NAS1-15100)

Avail: Issuing Activity CSCL 21H

Age related cracks in the graphite phenolic linear and/or ATJ insert in several nine year old Altair IIA solid rocket nozzles were investigated and determined to be limited to a single lot of nozzles. Test results and photomicrographs of fracture surfaces are presented which establish that in the discrepant nozzles the bond between the graphite fibers and the phenolic resin was tenacious, resulting in a nearly homogenous behavior. These materials are shown to have a relatively weak resin - fiber bond and behave more like a released fiber composite. Lot qualification fiber directional tensile strength and the chemical composition of the two materials were comparable, indicating that standard acceptance testing could not have differentiated between the desirable and undesirable material. Review of processing records failed to reveal any cause for the difference in the aging characteristics. K.L.

N80-17113* Vought Corp., Dallas, Tex.

SMALL ORBITAL TRANSFER VEHICLE FOR SHUTTLE OPERATIONS c16

Alfred I. Sibila *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 473-488 (For primary document see N80-17097 08-12)

(Contract NAS8-32710)

Avail: Issuing Activity CSCL 22B

Small orbital transfer vehicles to place payloads in orbits with altitudes above those of the standard Shuttle operation are studied. Low energy earth orbits below those of the planned spinning solid upper stages are addressed. Tandem and clustered solids are considered along with controlled solids, monopropellant and bipropellant liquids, and staged solid/liquid combinations. The performance, airborne support equipment, and program costs for the selected candidate concepts are presented. The results show that the most economical way to deliver the low energy payloads is with a modular liquid bipropellant stage system for the large majority of the payloads. The remainder of the payloads would use the Shuttle with integral OMS and Scout from WTR for a few specialized payloads until the Shuttle is operational at WTR. K.L.

N80-17114 Martin Marietta Corp., Denver, Colo.

PROPULSION CONCEPTS FOR SPACE TRANSFER OF LARGE SPACE STRUCTURES c20

W. E. Pipes *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 489-511 refs (For primary document see N80-17097 08-12)

(Contract F04701-77-C-0180)

Avail: Issuing Activity CSCL 21H

Large space structures that will carry solar cell arrays, highpowered communications relay antennas and large aperture sensor systems are considered and evaluated. The propulsion requirements are discussed and the propulsion systems that are compatible with deployable large space structures are defined. The propulsion concept, propellant, configuration, performance capabilities, and state of development are described. R.C.T.

N80-17115* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

STATUS OF FLUORINE/HYDRAZINE PROPULSION SYSTEMS TECHNOLOGY FOR PLANETARY MISSIONS c20

D. L. Bond and G. W. Kruger *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 513-527 refs (For primary document see N80-17097 08-12)

(Contract NAS7-100)

Avail: Issuing Activity CSCL 21H

The technology readiness of a high performance, liquid, space storable propulsion system is discussed. Both the design and analysis of a typical flight system and a demonstration system are described. The demonstration system was fabricated and tested to establish the credibility of the systems design. All identified safety concerns were addressed, and a positive endorsement was obtained for the system. The effort was very successful in that the system design appears feasible and was not radically different from previously flown spacecraft. No significant technical system problems were identified, and this fluorine/hydrazine system was included in premission studies for upcoming missions. R.C.T.

N80-17116* Jet Propulsion Lab., California Inst. of Tech., Pasadena. Applied Mechanics Div.
A SUMMARY AND UPDATE OF THE CONFIGURATION AND TEMPERATURE CONTROL STUDIES FOR A FLUORINE-HYDRAZINE PROPULSION SYSTEM c20
J. W. Stultz and R. A. Grippi *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 529-556 ref (For primary document see N80-17097 08-12)
(Contract NAS7-100)
Avail: Issuing Activity CSCL 21H

An integral tank design which combines the fluorine and helium pressurant tanks and two structural support concepts which significantly reduces the conductive thermal load are presented. Results of recent shield development testing which show that a hybrid shadow shield configuration reduces the radiation load to an acceptable value are discussed. Examples of spacecraft configuration changes necessary for a space storable propellant, as compared to an earth storable propellant, are given. Some general space storable spacecraft configuration guidelines are recommended for future mission planning. R.C.T.

N80-17117* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROGRESS ON A LIQUID FLUORINE-HYDRAZINE ROCKET ENGINE THRUST CHAMBER ASSEMBLY c20
M. A. Appel *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 557-582 refs (For primary document see N80-17097 08-12)
(Contract NAS7-100)
Avail: Issuing Activity CSCL 21H

The status of the 3560-N (800 lbf) rocket engine thrust chamber assembly for the space storable systems technology program is discussed. Specific items covered include sea level test results, analytical methods, carbon-carbon composite chambers and the problems encountered. R.C.T.

N80-17118* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MATERIALS COMPATIBILITY WITH FLUORINE c28
L. R. Toth, J. C. Lewis, and C. M. Moran *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 583-606 refs (For primary document see N80-17097 08-12)
(Contract NAS7-100)
Avail: Issuing Activity CSCL 21I

Materials compatibility information and results with liquid fluorine propellant are presented. Titanium alloy, 6A1-4V, was investigated for application on a fluorine-hydrazine propulsion system. The data show that the alloy is satisfactory for this application. R.C.T.

N80-17119* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CONTROL COMPONENT DEVELOPMENT FOR A FLUORINE-HYDRAZINE PROPULSION SYSTEM c20
R. S. Weiner, C. A. Solis, and R. Hagler, Jr. *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 607-633 refs (For primary document see N80-17097 08-12)
(Contract NAS7-100)
Avail: Issuing Activity CSCL 21H

The development of control components for fluorine systems is discussed. The pyrotechnic valve for propellant isolation during a spacecraft's cruise mode is emphasized. The survivability of the valve with fluorine is described when either squib reaction products or sheared particulates become exposed to the propellant. The valves (normally closed and normally open) feature 1.27 cm ports and are sized for a 3560-N thrust engine. The results obtained from tests of these valves with helium gas, liquid nitrogen, and fluorine are presented. R.C.T.

N80-17120*# National Aeronautics and Space Administration, Washington, D. C.
RESEARCH PROJECT MAURETANIA: SATELLITES AS DEVELOPMENT AIDS
Rupert Haydn, Helmut Bonarius, and Manfred Schramm Feb. 1980 18 p Transl. into ENGLISH from Bild Wiss. (West Germany), no. 11, 1979 p 151-161 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76064) Avail: NTIS HC A02/MF A01 CSCL 22A

A general discussion is presented of how satellite images and ground surveys are used to define land use. Specifically it deals with the Tagant region in Mauretania, West Africa. R.C.T.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-17121*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A GENERAL TIME ELEMENT USING CARTESIAN COORDINATES: ECCENTRIC ORBIT INTEGRATION
Guy Janin Jan. 1980 18 p refs
(NASA-TM-80942; JSC-16313) Avail: NTIS HC A02/MF A01 CSCL 22A

A general time element, valid with any arbitrary independent variables, and used with Cartesian coordinates for the integration of the elliptic motion in orbits, is examined. The derivation of the time element from a set of canonical elements of the Delaunay type, developed in the extended phase space, is presented. The application of the method using an example of a transfer orbit for a geosynchronous mission is presented. The eccentric and elliptic anomaly are utilized as the independent variable. The reduction of the in track error resulting from using Cartesian coordinates with the time element is reported. A.W.H.

N80-17122*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex. Mission Planning and Analysis Div.
HP-9825A HFRMP TRAJECTORY PROCESSOR (#TRAJ), DETAILED DESCRIPTION
S. M. Kindall Jan. 1980 277 p
(NASA-TM-80941; JSC-6397; Rept-80-FM-9) Avail: NTIS HC A13/MF A01 CSCL 22A

The computer code for the trajectory processor (#TRAJ) of the high fidelity relative motion program is described. The #TRAJ processor is a 12-degrees-of-freedom trajectory integrator (6 degrees of freedom for each of two vehicles) which can be used to generate digital and graphical data describing the relative motion of the Space Shuttle Orbiter and a free-flying cylindrical payload. A listing of the code, coding standards and conventions, detailed flow charts, and discussions of the computational logic are included. A.R.H.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N80-17107 Massachusetts Inst. of Tech., Cambridge. Francis Bitter National Magnet Lab.
ELECTROMAGNETIC GUNS, LAUNCHERS AND REACTION ENGINES
Henry H. Kolm *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 329-346 refs (For primary document see N80-17097 08-12)
(Grant DAAG29-78-G-0147)
Avail: Issuing Activity

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-17123*# LinCom Corp., Pasadena, Calif.
A GROUND BASED PHASE CONTROL SYSTEM FOR THE SOLAR POWER SATELLITE, VOLUME 4 Final Report
C. M. Chie Jan. 1980 66 p refs
(Contract NAS9-15782)
(NASA-CR-160458; TR-0180-0779) Avail: NTIS HC A04/MF A01 CSCL 22B

A ground phase control system is studied as an alternative approach to the current reference retrodirective phase control system in order to simplify the spaceborne hardware requirement. Based on waveform selections, functional subsystems to implement the ground-based phase control concept are identified and functionally represented. It was concluded that the feasibility of the concept becomes unclear if the conditions of the ionosphere and satellite motion are not met. M.M.M.

N80-17124# Research Inst. of National Defence, Linkoeping (Sweden).
CURRENT SOVIET SPACE PROGRAMS [NAAGRA UPPGIFTER OM AKTUELLA SOVJETISKA SATELLITERS VERKSAMHET]
Astrid Rundkwist Feb. 1979 40 p refs In SWEDISH
(FOA-C-30160-F4) Avail: NTIS HC A03/MF A01

A discussion of the Soviet space program is presented. The utility of satellites for the study of meteorological phenomena, and in the manufacturing of optical materials and metal alloys under zero gravity conditions is shown. Author (ESA)

N80-17125# British Aerospace Dynamics Group, Bristol (England). Electronics and Space Systems.
GEOS 3. VOLUME 1: EXECUTIVE SUMMARY Final Report
T. Kilvington, P. D. Matthews, P. Vangasse, P. Braund, T. Morley, E. Crellin, J. Pope, F. G. Harding, L. Virdee, and A. P. Vickery Mar. 1979 181 p refs 3 Vol.
(Contract ESA-3811/78-NL-MS)
(ESS/SS-922-Vol-1; ESA-CR(P)-1226-Vol-1) Avail: NTIS HC A09/MF A01

The technical aspects of the GEOS 3 which is to be launched on Ariane in tandem with another spacecraft by 1983 are discussed. Four distinct mission options are investigated and the feasibility of each option is discussed. The options are: a near polar lunar orbiter; a lunar orbiter with a transfer trajectory similar to that of option one; an operational orbit with the apogee lying about a lunar distance in the opposite direction to the sun; and the exploration of the far reaches of the magnetotail by orbiting the L2 point of the Earth-Sun system. Proposed configurations are described, as well as the sensor options for all missions. The rate of scientific return and other parameters used to compare mission effectiveness are discussed. Author (ESA)

N80-17126# Research Inst. of National Defence, Linkoeping (Sweden).
DIMENSIONING OF LV-RB TYPE 3 MISSILE AND PARAMETER STUDY OF RB BEHAVIOR BY SIMULATING WITH A COMPUTER [DIMENSIONERING AV LVRB TYP 3 SAMT PARAMETERSTUDIER AV RB-UPPFOERANDE GENOM SIMULERING I CSMP]
Kurt Andersson, John Sundelin, and Erik Aastroem Jul. 1979 38 p refs In SWEDISH
(FOA-C-20309-E3) Avail: NTIS HC A03/MF A01

An approximate dimensioning of body and components of LV-RB missiles is discussed. A computer simulation with the continuous system modelling program (CSMP) was run, obtaining the performance characteristics for each case. Three types of missiles were considered, dependent upon target velocity and position. A set of charts and tables showing the estimated flight performance of the missiles is presented. Author (ESA)

N80-17127# Research Inst. of National Defence, Linkoeping (Sweden).
COMPUTER PROGRAM FOR ANALYSIS OF SPEED AND RANGE FOR A GIVEN MISSILE WITH A KNOWN THRUST TIME DIAGRAM [CSMP-PROGRAM FOER ANALYS AV HASTIGHET OCH RAECKVIDD FOER GIVEN ROBOT MED GIVEN DRAGKRAFTPROGRAM]
Erik Aastroem Jul. 1979 23 p refs In SWEDISH
(FOA-C-20310-E3) Avail: NTIS HC A02/MF A01

The continuous system modeling program (CSMP) is described. The use of the program to simulate missile parameters such as velocity and range is discussed. Acceleration diagrams and lateral distance covering are discussed. The program is derived from the basic equations, from which a block diagram is developed. Each block represents a mathematical operation. Examples in the form of tables and diagrams are presented. Author (ESA)

N80-17128# Research Inst. of National Defence, Linkoeping (Sweden).
COLLIMATION CONTROL LIMITS FOR LVRB TYPE 3 MISSILES KOLLIMATIONSSTRYNINGSBEGRAENSINGAR, LVRB TYP 3]
Goesta Hall, Goeran Lyman, and Inga Nordstroem Jul. 1979 44 p refs In SWEDISH
(FOA-C-20311-E3) Avail: NTIS HC A03/MF A01

The limits of acceleration, velocity in the proximity of the target, and sight angle for collimation controlled LV missiles were studied to examine the influence of the target and missile parameters on the surface covering of collimation controlled missiles. Results in the form of charts and tables are presented for four different types of missiles. Author (ESA)

N80-17129# Research Inst. of National Defence, Linkoeping (Sweden).
COLLIMATION CONTROL KINEMATICS [KOLLIMATIONSSTYRNINGSKINEMATIK]
Jonas Agerberg Jul. 1979 16 p refs In SWEDISH
(FOA-C-20312-E3) Avail: NTIS HC A03/MF A01

A computer program which determines the tangential acceleration and sight angle of a collimation controlled missile approaching a target is described. Limiting values of the variables associated with this type of missile control are examined. Radial and tangential accelerations, and the coordinates of missile and target, entered at the computer terminal as initial data are discussed. The results are presented in tabular form using the horizontal distance as an independant parameter. Author (ESA)

N80-17130# Research Inst. of National Defence, Linkoeping (Sweden).
KINEMATIC MODEL FOR COLLIMATION CONTROLLED AIR DEFENSE MISSILE (KINK) [KINEMATISK MODELL FOER KOLLIMATIONSSTYRD LUFTVAERNSROBOT (KINK)]
Goeran Lyman and Inga Nordstroem Jul. 1979 48 p refs In SWEDISH
(FOA-C-20313-E3) Avail: NTIS HC A03/MF A01

A mathematical model which describe the trajectory of a collimation controlled air defense missile is presented. The mode is three dimensional and assumes that the missile is assumed to be kinematic and always in line of sight of the target. The description of the trajectory is integrated from the thrust diagram and air resistance, taking into account the variation derived from altitude and velocity. Two simulation programs, differing in language, integration ability, and information produced are discussed. Author (ESA)

N80-17131# Research Inst. of National Defence, Linkoeping (Sweden).
SIDE-LOOKING TARGET SEEKING MISSILE GUIDANCE SYSTEMS [INVERKAN PAA ETT SYFTBAERINGSMAALSOEKANDE ROBOTSYSTEMS TAEKNINGSOMRAADE AV MAALSOEKARENS SNGDTITTNINGSFOERMAAGA]
Aake Assarsson Jul. 1979 19 p refs In SWEDISH
(FOA-C-20314-E3) Avail: NTIS HC A02/MF A01

The influence of the side looking feature of a missile guidance system on its field of vision at both constant and changing velocities is described. Examples of limitations are given for a missile with a given speed curve using a kinematic model of a target seeking missile. Rules for calculating the limits of the fluid of vision for a variable velocity missile are presented. For the above cases the target is moving on a straight trajectory at a constant speed. In the case of a maneuvering target, calculations become difficult and limit determinations must be made by simulation rather than modeling. Author (ESA)

N80-17132# Research Inst. of National Defence, Linkoeping (Sweden).

ALTERNATIVE STEERING PRINCIPLES FOR LVRR MISSILES [NAAGRA ALTERNATIVA STYRPRINCIPIER FOER LVR]

Magnus Herolf Jul. 1979 23 p refs In SWEDISH
(FOA-C-20319-E3) Avail: NTIS HC A02/MF A01

A preliminary study of some aspects of missile steering is presented. The estimation of target trajectory and target recognition were investigated using regression analysis and adaptive Kalman filters. Application of nonlinear prediction is discussed. Some steering techniques are analyzed, including the control of the tangent acceleration and steering towards the predicted collision point. Author (ESA)

N80-17099 Martin Marietta Corp., Denver, Colo.

MX BREAKOUT AND ERECTION SYSTEM DEVELOPMENT

Loman T. Park *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 25-62 (For primary document see N80-17097 08-12)
(Contract F04704-77-C-0008)
Avail: Issuing Activity

N80-17100 Vought Corp., Dallas, Tex.

ALVRJ FLIGHT TEST PROGRAM SUMMARY

L. E. Pearson *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 63-82 (For primary document see N80-17097 08-12)
Avail: Issuing Activity

N80-17302*# Raytheon Co., Bedford, Mass. Missile Systems Div.

SHOCK ISOLATION PLATFORM FOR SEASPARROW LAUNCHER

Paul V. Roberts *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 85-95 refs (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 16A

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N80-17133*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SPACE SHUTTLE SOLID ROCKET BOOSTER COST-PER-FLIGHT ANALYSIS TECHNIQUE

J. Alan Forney Dec. 1979 172 p
(NASA-TM-78259) Avail: NTIS HC A08/MF A01 CSCL 20H

A cost per flight computer model is described which considers: traffic model, component attrition, hardware useful life, turnaround time for refurbishment, manufacturing rates, learning curves on the time to perform tasks, cost improvement curves on quantity hardware buys, inflation, spares philosophy, long lead, hardware funding requirements, and other logistics and scheduling constraints. Additional uses of the model include assessing the cost per flight impact of changing major space shuttle program parameters and searching for opportunities to make cost effective management decisions. R.C.T.

N80-17109* Thiokol Corp., Brigham City, Utah. Wasatch Div.

SPACE SHUTTLE SRM DEVELOPMENT

I. C. Adams and F. W. Call *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 405-436 (For primary document see N80-17097 08-12)
(Contract NAS8-30490)
Avail: Issuing Activity CSCL 22B

N80-17110* Rockwell International Corp., Downey, Calif. Space Systems Group.

IMPROVING PERFORMANCE OF THE SPACE SHUTTLE

D. L. Gerhardt and N. A. Bremberg *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 437-445 (For primary document see N80-17097 08-12)
(Contract NAS9-1400)
Avail: Issuing Activity CSCL 22B

N80-17113* Vought Corp., Dallas, Tex.

SMALL ORBITAL TRANSFER VEHICLE FOR SHUTTLE OPERATIONS

Alfred I. Sibila *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 473-488 (For primary document see N80-17097 08-12)
(Contract NAS8-32710)
Avail: Issuing Activity CSCL 22B

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

N80-17134*# National Aeronautics and Space Administration, Washington, D. C.

SPACECRAFT FOR FLIGHT IN THE ATMOSPHERE OF VENUS

G. M. Moskalenko Feb. 1980 13 p Transl. into ENGLISH from Zemlya Vselennaya (USSR), no. 4, Jul. - Aug. 1979 p 21-26 Transl. by JPRS, Arlington, Va.
(NASA-TM-75932) Avail: NTIS HC A02/MF A01 CSCL 22B

Possible configurations of space vehicles which would be delivered to Venus by rocket system in order to autonomously carry out flights in an automatic (and possibly piloted) mode are considered with respect to mission and flight altitude. Base (high altitude) vehicles, operating at pressure, sendity, and temperature corresponding to those on Earth at sea level, will have little maneuverability, will serve as carriers for equipment, scientific devices, and other cargo, and will study the gas composition of the Venus atmosphere from above. Low altitude vehicles will explore the planet from flight altitude in the vicinity of the planet's surface, as well as land on it. Analogous to deep submergence vehicles such as the bathyscaphe and the bathyplane, they will have a certain amount of maneuverability and will study the atmospheric boundary layer from below. The advantages of aerostats in this environment are discussed. Drawings of the aerostatic base station, the variable-length aerostatic sing vehicle, and the hybrid aerostatic vehicle with attached wings are included. A.R.H.

N80-17135*# Kollmorgen Corp., Radford, Va. Research and Development Center.
LABORATORY SIMULATION OF IRRADIATION-INDUCED DIELECTRIC BREAKDOWN IN SPACECRAFT CHARGING Final Report, 1 Apr. 1977 - 30 Nov. 1979
Edward J. Yadlowsky, Russell J. Churchill, and Robert C. Hazelton
13 Feb. 1980 53 p refs
(Grant NsG-3145)
(NASA-CR-162762) Avail: NTIS HC A04/MF A01 CSCL 22B

The discharging of dielectric samples irradiated by a beam of monoenergetic electrons is investigated. The development of a model, or models, which describe the discharge phenomena occuring on the irradiated dielectric targets is discussed. The electrical discharge characteristics of irradiated dielectric samples are discussed and the electrical discharge paths along dielectric surfaces and within the dielectric material are determined. The origin and destination of the surface emitted particles is examined and the charge and energy balance in the system is evaluated. A.W.H.

N80-17254 Hughes Aircraft Co., El Segundo, Calif.
TRANSFER FUNCTION APPLICATIONS TO SPACECRAFT STRUCTURAL DYNAMICS
J. R. Fowler and E. Dancy (Hewlett-Packard Co., Los Angeles) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 93-101 refs (For primary document see N80-17247 08-31)
(Contract IS-774)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17281 Martin Marietta Corp., Denver, Colo.
USE OF A SHOCK SPECTRA TO EVALUATE JITTER OF A FLEXIBLE MANEUVERING SPACECRAFT
William J. Kacena *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 39-47 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-17136*# National Aeronautics and Space Administration. Washington, D. C.
GLOSSARY OF TERMS AND TABLE OF CONVERSION FACTORS USED IN DESIGN OF CHEMICAL PROPULSION SYSTEMS
Russell B. Keller, Jr., comp. Oct. 1979 89 p
(NASA-SP-8126) Avail: NTIS HC A05/MF A01 CSCL 21H

The glossary presented is based entirely on terms used in the monographs on Chemical Propulsion. Significant terms relating to material properties and to material fabrication are presented. The terms are arranged in alphabetical order, with multiple word terms appearing in the normal sequence of usage; for example, ablative cooling appears as such, not as cooling, ablative, and lip seal appears as such, not as seal, lip. Conversion Factors for converting U.S. customary units to the International System of Units are presented in alphabetical order of the physical quantity (e.g., density, heat flux, specific impulse) involved. M.M.M.

N80-17137*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
PHYSICAL PHENOMENA IN MERCURY ION THRUSTERS Annual Report, 1 Dec. 1978 - 1 Dec. 1979
Paul J. Wilbur Dec. 1979 146 p refs
(Grant NGR-06-002-112)
(NASA-CR-159784) Avail: NTIS HC A07/MF A01 CSCL 21C

Experimental tests results demonstrating that reductions in screen grid thickness enhance the performance of ion thruster grids are presented. Shaping of the screen hole cross section is shown on the other hand not to affect performance substantially. The effect of the magnetic field in the vicinity of the hollow cathode on cathode performance is studied and test results are presented that show reductions in keeper voltages of a few volts can be realized by judicious applications of fields on the order of 100 gauss. The plasma downstream of a SERT 2 thruster operating without high voltage is studied. A model describing electron escape from the thruster under these conditions is discussed. A model defining the performance of the baffle aperture of an ion thruster is refined and experimental verification of the model is undertaken. Author

N80-17138*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTICAL INVESTIGATION OF TWO HYDROGEN OXYGEN ROCKET ENGINE SYSTEMS FOR LOW-THRUST APPLICATION
Dean D. Scheer 1980 17 p refs Presented at JANNAF Propulsion Meeting, Monterey, Calif., 11-13 Mar. 1980
(NASA-TM-81420; E-343) Avail: NTIS HC A02/MF A01 CSCL 21H

Two hydrogen oxygen rocket engine system concepts were analyzed parametrically over a thrust range from 100 to 1000 pounds and a chamber pressure range from 175 to 1000 psia. Both concepts were regeneratively cooled with hydrogen and were pump fed by electric motor driven positive displacement pumps. Electric power was provided by either a turboalternator (turboalternator concept) or some means external to the engine system (auxiliary power concept). The turboalternator concept is discussed. The computer program used to conduct the analyses along with the design characteristics of the major engine system components is described. The feasible design range of the systems over the parametric range of thrust is discussed in terms of allowable chamber pressure. Engine system estimated performance, mass, and dimensional envelope parametric data within the feasible design range are presented. A.W.H.

N80-17139*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLID ROCKET BOOSTER THRUST VECTOR CONTROL SUBSYSTEM VERIFICATION TEST (V-2) REPORT
Boris Pagan Dec. 1979 174 p
(NASA-TM-78258) Avail: NTIS HC A08/MF A01 CSCL 21H

The results of the verification testing sequence V-2 performed on the space shuttle solid rocket booster thrust vector control subsystem are presented. A detailed history of the hot firings plus additional discussion of the auxiliary power unit and the hydraulic component performance is presented. The test objectives, data, and conclusions are included. R.C.T.

N80-17140*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FINITE ELEMENT MODELS OF THE SPACE SHUTTLE MAIN ENGINE
G. R. Muller Jan. 1980 70 p refs
(NASA-TM-78260) Avail: NTIS HC A04/MF A01 CSCL 21H

Finite element models were developed as input to dynamic simulations of the high pressure fuel turbopump (HPFTP), the high pressure oxidizer turbopump (HPOTP), and the space shuttle main engine (SSME). Descriptions are provided for the five basic finite element models: HPFTP rotor, HPFTP case, HPOTP rotor, HPOTP case, and SSME (excluding turbopumps). Modal results are presented for the HPFTP rotor, HPFTP case, HPOTP rotor, coupled HPFTP rotor and case, HPOTP case, coupled HPOTP rotor and case, SSME (excluding turbopumps), and SSME (including turbopumps). Results for the SSME (including turbopumps) model are compared to data from a SSME HPOTP modal survey. R.C.T.

N80-17141*# Rocketdyne, Canoga Park, Calif.
ADVANCED COOLING TECHNIQUES FOR HIGH-PRESSURE HYDROCARBON-FUELED ENGINES Final Report, Aug. 1978 - Oct. 1979
R. T. Cook Oct. 1979 230 p refs
(Contract NAS3-21381)
(NASA-CR-159790; RI/RD79-310) Avail: NTIS HC A11/MF A01 CSCL 21H

The regenerative cooling limits (maximum chamber pressure) for O2/hydrocarbon gas generator and staged combustion cycle rocket engines over a thrust range of 89,000 N (20,000 lbf) to 2,669,000 N (600,000 lbf) for a reusable life of 250 missions were defined. Maximum chamber pressure limits were first determined for the three propellant combinations (O2/CH4, O2/C3H8, and O2/RP-1 without a carbon layer (unenhanced designs). Chamber pressure cooling enhancement limits were then established for seven thermal barriers. The thermal barriers evaluated for these designs were: carbon layer, ceramic coating, graphite liner, film cooling, transpiration cooling, zoned combustion, and a combination of two of the above. All fluid barriers were assessed a 3 percent performance loss. Sensitivity studies were then conducted to determine the influence of cycle life and RP-1 decomposition temperature on chamber pressure limits. Chamber and nozzle design parameters are presented for the unenahanced and enhanced designs. The maximum regenerative cooled chamber pressure limits were attained with the O2/CH4 propellant combination. The O2/RP-1 designs relied on a carbon layer and liquid gas injection chamber contours, short chamber, to be competitive with the other two propellant combinations. This was attributed to the low decomposition temperature of RP-1. R.C.T.

N80-17142*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PLUME CHARACTERIZATION OF A ONE-MILLIPOUND SOLID TEFLON PULSED PLASMA THRUSTER, PHASE 2 Final Report, 1 Mar. 1978 - 30 Apr. 1979
L. K. Rudolph, K. G. Harstad, L. C. Pless, and R. M. Jones Sep. 1979 150 p refs Sponsored by NASA
(Contracts F04611-78-X-0034; F04611-79-X-0026)
(NASA-CR-162786; JPL-Pub-79-105; AFRPL-TR-79-60) Avail: NTIS HC A07/MF A01 CSCL 21H

Measurements of the pulsed plasma thruster (PPT) plume upstream mass flux were made in the Molecular Sink (MOLSINK) vacuum facility in order to minimize the plume-tank wall reflected mass flux. Using specially designed collimators on 4 rows of Quartz Crystal Microbalanced (QCMs) mounted on a support extending radially away from the plume axis, measurements were made of the mass flux originating in a thin slice of the PPT primary plume at an arbitrary dip angle with respect to the thruster axis. The measured and analytically corrected mass flux from particles reflected from the MOLSINK walls was substracted from the collimated QCM measurements to improve their accuracy. These data were then analytically summed over dip angle to estimate the total plume backflow upstream of the thruster nozzle. The results indicate that the PPT backflow is of order 10 to the minus 10th power g/square cm/pulse in the region from 38 to 86 cm from the PPT axis in the nozzle exit plane. This flux drops with the square of the radial distance from the PPT axis and is comparable to the backflow of an 8 cm ion thruster, which has performance characteristics similar to those of the PPT. R.C.T.

N80-17098 Thiokol Corp., Elkton, Md.
MX CANISTER EJECT GAS GENERATOR
Donald R. Reed, E. Lynn Thomas, Joseph E. Reardon, and Winthrop L. Cummings (Westinghouse Elec. Corp., Sunnyvale) *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 1-24 (For primary document see N80-17097 08-12)
(Contract F04704-75-C-0010)
Avail: Issuing Activity

N80-17105 Brunswick Corp., Lincoln, Nebr.
DEVELOPMENT OF A COMPOSITE MOTOR CASE FOR THE VIPER ANTITANK WEAPON SYSTEM
A. R. Cederberg *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 145-157 (For primary document see N80-17097 08-12)
(Contract DAAH01-76-C-0658)
Avail: Issuing Activity

N80-17106 Boeing Aerospace Co., Huntsville, Ala. Army Systems Div.
ROCKET MOTOR PEAK NOISE REDUCTION PROGRAM
Charles R. Carter *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 159-185 refs (For primary document see N80-17097 08-12)
(Contract DAAK40-78-C-0038)
Avail: Issuing Activity

N80-17108 Army Armament Research and Development Command, Dover, N. J.
CONTROLLING STOCKPILED PROPELLANT
Gayton Silvestro *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 347-358 refs (For primary document see N80-17097 08-12)
Avail: Issuing Activity

N80-17111 ARO, Inc., Arnold Air Force Station, Tenn. AEDC Div.
FACILITY REQUIREMENTS FOR IUS SOLID-PROPELLANT ROCKET MOTOR TESTING
F. D. Cantrell and C. H. Kunz *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 447-457 refs (For primary document see N80-17097 08-12)
Avail: Issuing Activity CSCL 21H

N80-17112*# Vought Corp., Dallas, Tex.
AGING PROBLEMS IN GRAPHITE PHENOLIC NOZZLE LINERS
G. S. McCorkle *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 461-472 ref (For primary document see N80-17097 08-12)
(Contract NAS1-15100)
Avail: Issuing Activity CSCL 21H

N80-17114 Martin Marietta Corp., Denver, Colo.
PROPULSION CONCEPTS FOR SPACE TRANSFER OF LARGE SPACE STRUCTURES
W. E. Pipes *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 489-511 refs (For primary document see N80-17097 08-12)
(Contract F04701-77-C-0180)
Avail: Issuing Activity CSCL 21H

N80-17115* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
STATUS OF FLUORINE/HYDRAZINE PROPULSION SYSTEMS TECHNOLOGY FOR PLANETARY MISSIONS
D. L. Bond and G. W. Kruger *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 513-527 refs (For primary document see N80-17097 08-12)
(Contract NAS7-100)
Avail: Issuing Activity CSCL 21H

N80-17116* Jet Propulsion Lab., California Inst. of Tech., Pasadena. Applied Mechanics Div.
A SUMMARY AND UPDATE OF THE CONFIGURATION AND TEMPERATURE CONTROL STUDIES FOR A FLUORINE-HYDRAZINE PROPULSION SYSTEM
J. W. Stultz and R. A. Grippi *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 529-556 ref (For primary document see N80-17097 08-12)
(Contract NAS7-100)
Avail: Issuing Activity CSCL 21H

N80-17117* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROGRESS ON A LIQUID FLUORINE-HYDRAZINE ROCKET ENGINE THRUST CHAMBER ASSEMBLY
M. A. Appel *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 557-582 refs (For primary document see N80-17097 08-12)
(Contract NAS7-100)
Avail: Issuing Activity CSCL 21H

N80-17119* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CONTROL COMPONENT DEVELOPMENT FOR A FLUORINE-HYDRAZINE PROPULSION SYSTEM
R. S. Weiner, C. A. Solis, and R. Hagler, Jr. *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 607-633 refs (For primary document see N80-17097 08-12)
(Contract NAS7-100)
Avail: Issuing Activity CSCL 21H

N80-17279 Ballistic Research Labs., Aberdeen Proving Ground, Md.
ROCKET MOTOR RESPONSE TO TRANSVERSE BLAST LOADING
Norris J. Huffington, Jr. and Henry L. Wisniewski *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 21-32 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-17143# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
MATERIALS AND STRUCTURES RESEARCH SCIENTIFIC REPORT, 1978 Progress Report [FORSCHUNGSBEREICH WERKSTOFFE UND BAUWEISEN: WISSENSCHAFTLICHER BERICHT STAND 1978]
1978 101 p refs In GERMAN Original contains color illustrations
Avail: NTIS HC A06/MF A01

Research in structural engineering, aerodynamics, the mechanical properties of light alloys and refractory materials, the applications of powder metallurgy, the space environment, energy, health problems, and weightlessness are discussed.
Author (ESA)

24 COMPOSITE MATERIALS

Includes laminates.

N80-17144 Rutgers - The State Univ., New Brunswick, N. J.
MECHANICAL BEHAVIOR OF COMPOSITE MATERIALS IN MULTIAXIAL STRESS FIELDS Ph.D. Thesis
Joo Won Kim 1979 191 p
Avail: Univ. Microfilms Order No. 7928413

The stress-strain behavior of glass fiber reinforced Nylon-6 and polycarbonate in tension compression and shear superimposed on hydrostatic pressures of various intensities was investigated. The experimental results on Nylon-6 composites showed that the tensile and shear moduli increased linearly and the strength, defined as the maximum stress in tension and the stress at 2 percent offset strain in compression and shear, increased nonlinearly with pressure. For polycarbonate composites, the modulus and the strength both increased with pressure but the increases were rather modest. The effects of adding glass fibers to form composite materials were shown to be much less for polycarbonate composites than for Nylon-6 composites in tension, compression and shear. A three dimensional model based on a plane stress model was developed to predict the maximum strengths of the composites.
Dissert. Abstr.

N80-17145 California Univ., Berkeley.
PROPERTIES, MICROSTRUCTURES AND RADIATION RESISTANCE OF STAINLESS STEEL-GLASS COMPOSITE MATERIALS Ph.D. Thesis
Robert Allan Clark 1979 128 p
Avail: Univ. Microfilms Order No. 8000308

A composite material consisting of glass platelets in a 316L stainless steel matrix was developed by standard techniques using glass and metal powders. Mechanical properties were determined as a function of type and amount of glass in the composite and processing history. These results were correlated with composite microstructures. The best mechanical properties were achieved from specimens machined out of larger powder compacts that had been: (1) steel die compacted at 70 ksi for two minutes; (2) hydrogen sintered at 1300 C for one hour; (3) hot rolled to a single pass 30 percent reduction at 950 C in a protective atmosphere; and (4) annealed one hour at 1000 C. The irridation experiment showed that a fine grained powder metallurgy product did not improve nor degrade resistance to blistering under He+ ion bombardment relative to values obtained for similar wrought materials. No benefit in terms of reduced void formation and swelling would be derived from use of this material in a reactor environment.
Dissert. Abstr.

N80-17146 Iowa State Univ. of Science and Technology, Ames.
FRACTURE MECHANICS OF UNIDIRECTIONAL COMPOSITE MATERIALS Ph.D. Thesis
Shahrokh Parhizgar 1979 82 p
Avail: Univ. Microfilms Order No. 8000164

The available mathematical theories and principles needed for the full investigation of fracture in orthotropic plates are documented. The fracture phenomena in orthotropic composite plates are examined and compared with the fracture in isotropic plates. The extent to which the principles of linear fracture mechanics are applicable to orthotropic plates is studied. It is shown that fracture toughness of unidirectional composites is independent of crack length but dependent on crack-fiber orientation. For experimental verification of the above principles, unidirectional glass epoxy material (Scotchply 1002) was used. The fracture toughness of Scotchply 1002 for different crack-fiber orientations is obtained by utilizing Solid Sap finite element program and compact tension specimens. An empirical formula relating the fracture toughness of the material for different crack-fiber orientations is found.
Dissert. Abstr.

N80-17147*# Boeing Commercial Airplane Co., Seattle, Wash.
THE 737 GRAPHITE COMPOSITE FLIGHT SPOILER FLIGHT SERVICE EVALUATION Annual Report, May 1978 - Apr. 1979
Daniel J. Hoffman and Robert L. Stoecklin Jan. 1980 56 p refs
(Contract NAS1-11668)
(NASA-CR-159094; AR-5) Avail: NTIS HC A04/MF A01 CSCL 11D

The flight service experience of 111 graphite-epoxy spoilers on 737 transport aircraft and related ground based enviromental exposure of graphite-epoxy material specimens is reported. Spoilers were installed on 28 aircraft representing seven major airlines operating throughout the world. Over 1,188,367 spoiler flight hours and 1,786,837 spoiler landings were accumulated by this fleet. Tests of removed spoilers and ground-based exposure specimens after the fifth year of service indicate modest changes in composite strength properties. Two incidents of trailing edge delamination with subsequent core corrosion were observed. Based on visual, ultrasonic, and destructive testing, there has been no evidence of moisture migration into the honeycomb core and no core corrosion.
K.L.

N80-17148*# Boeing Commercial Airplane Co., Seattle, Wash.
PRELIMINARY DESIGN OF GRAPHITE COMPOSITE WING PANELS FOR COMMERCIAL TRANSPORT AIRCRAFT
B. A. Byers and Robert L. Stoecklin Feb. 1980 68 p refs
(Contract NAS1-15107)
(NASA-CR-159150) Avail: NTIS HC A04/MF A01 CSCL 11D

Subjectively assessed practical and producible graphite/epoxy designs were subjected to a multilevel screening procedure which considered structural functions, efficiency, manufacturing and producibility, costs, maintainability, and inspectability. As each progressive screening level was reviewed, more definitive information on the structural efficiency (weight), manufacturing, and inspection procedures was established to support the design selection. The configuration features that enhance producibility of the final selected design can be used as a generic base for application to other wing panel designs. The selected panel design showed a weight saving of 25 percent over a conventional aluminum design meeting the same design requirements. The estimated cost reduction in manufacturing was 20 percent, based on 200 aircraft and projected 1985 automated composites manufacturing capability. The panel design background information developed will be used in the follow-on tasks to ensure that future panel development represents practical and producible design approaches to graphite/epoxy wing surface panels. A.R.H.

N80-17149# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
BASIC CONCEPTS OF STATISTICS AND THEIR APPLICATIONS IN COMPOSITE MATERIALS Final Report, 1 Dec. 1978 - 31 Jan. 1979
Won J. Park Jun. 1979 70 p refs
(AD-A076198; AFML-TR-79-4070) Avail: NTIS HC A04/MF A01 CSCL 11/4

This report is intended to present, in a simple and concise way, basic concepts of statistics and their applications in composite material engineering. The subjects are selected from the standpoint of key concepts and applications rather than theory and elegance. It is envisioned that this report is suitable for a short course (or refresher course) for composite material engineers, who have been working with data but have not done any formal course work in statistics. GRA

N80-17150# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
NONDESTRUCTIVE EVALUATION OF DAMAGE IN METAL MATRIX COMPOSITES Interim Report
Edmund G. Henneke, II, Kenneth L. Reifsnider, Wayne W. Stinchcomb, and John E. Duke 30 Jan. 1979 53 p refs
(Contract N00014-78-C-0153)
(AD-A075284) Avail: NTIS HC A04/MF A01 CSCL 14/2

The basic objectives of this work were: to apply nondestructive evaluation techniques to metal matrix composites; to obtain base line data as to the ability of these techniques to locate, identify and quantify defects in these materials; to determine the effect of these defects on strength and stiffness; and to modify the techniques as required for application to specimens having geometries other than the flat tensile coupon. Several different nondestructive testing techniques have been considered for possible application to metal matrix composites. A decription of these is given in the following pages. Some of these methods have been applied during the past year to Al/Fp fiber composites while others have been investigated in a preliminary fashion in order to determine potential problem areas that will need to be solved for proper application in the coming year. GRA

N80-17151# Virginia Polytechnic Inst. and State Univ., Blacksburg.
DEFECT-PROPERTY RELATIONSHIPS IN COMPOSITE MATERIALS, PART 4 Final Report, 7 Feb. 1977 - 6 Feb. 1979
Kenneth L. Reifsnider, Edmund G. Henneke, II, and Wayne W. Stinchcomb Wright-Patterson AFB, Ohio AFML Jun. 1979 146 p refs
(Contract F33615-77-C-5044; AF Proj. 2419)
(AD-A076497; AFML-TR-76-81-Pt-4) Avail: NTIS HC A07/MF A01 CSCL 11/4

This report describes the results of an investigation of the nature of damage in two graphite-epoxy laminates under various loading histories, with special attention to the changes in mechanical properties caused by specific damage mechanisms. The results include several new findings, the development of unique investigative methods and some substantial deviations from common model predictions. The discovery of a 'characteristic damage state' is reported. GRA

N80-17152# General Dynamics/Convair, San Diego, Calif.
COMPOSITE MATERIAL APPLICATION TO THE MK12A RV MIDBAY SUBSTRUCTURE Final Report, Oct. 1976 - Jul. 1978
W. Garcia, J. Hertz, J. Prunty, and H. McCutchen Sep. 1979 162 p refs
(Contract DAAG46-76-C-0073; DA Proj. 1W1-62113-A-661)
(AD-A076485; CASD/ASC-76-001A; AMMRC-TR-79-51) Avail: NTIS HC A08/MF A01 CSCL 22/2

The work reported herein represents a feasibility study to reduce weight of the MK12A reentry vehicle midbay structure by replacing the aluminum structure with graphite composite materials. Following conceptual design of the MK12A midbay structure utilizing advanced composite materials, the effort was redirected to the Advanced Ballistic Reentry Vehicle (ABRV). Specimens and subcomponent elements representative of the ABRV configuration were provided for nuclear vulnerability and hardness testing of the Air Force Weapons Laboratory. GRA

N80-17153# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
POOLED ESTIMATIONS OF THE PARAMETERS ON WEIBULL DISTRIBUTIONS Final Report, 15 Jan. - 30 Jun. 1979
Won J. Park Aug. 1979 48 p refs
(AF Proj. 2303)
(AD-A076513; AFML-TR-79-4112) Avail: NTIS HC A03/MF A01 CSCL 11/4

In composite materials fatigue life testing under different levels of stress, the underlying distributions are assumed to be the Weibull distribution with the common shape parameter. The problems of estimations and testing hypotheses regarding the common shape parameter and scale parameters in the Weibull distributions are considered. The results are: three methods of pooled estimation of the shape parameter, exact confidence intervals and testing hypotheses for the shape parameter, comparison of the bias factor of three pooled estimators of the shape parameter and exact confidence intervals and testing hypotheses for the scale parameters. Examples are given for composite material applications. GRA

N80-17154# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
TRIBOLOGICAL BEHAVIOR OF METAL MATRIX COMPOSITES Interim Report
M. F. Amateau, R. F. Flowers, and E. Eliezer 14 Sep. 1979 32 p refs
(Contract F04701-78-C-0079)
(AD-A075764; TR-0079-(4762-03)-1; SAMSO-TR-79-56) Avail: NTIS HC A03/MF A01 CSCL 11/4

The wear and friction behavior of continuous graphite-fiber-reinforced metal matrix composites was investigated. Composite materials were tested against 4620 steel at 54 m/sec at room temperature in air without lubricant. The graphite fibers studied included rayon-based, pitch-based, and polyacrilonitrile (PAN)-based fibers. Both high-modulus and high-strength PAN-based fibers were examined. The fibers were incorporated into Cu- and Ag- based alloys by means of a liquid metal infiltration technique. The results of this study indicate that the type of graphite fiber in the composite is the most significant factor in the wear and friction behavior of metal matrix composites. In some high-modulus fiber Sn-bronze composites fiber fraction influences wear rate, but not coefficient of friction. Neither the matrix alloy nor the composite tensile strength per se correlates with the friction and wear properties; however, there are specific trends for the various matrix alloys. GRA

N80-17155# Textron Bell Helicopter, Fort Worth, Tex.
FILAMENT WINDING PRECISION RESIN IMPREGNATION SYSTEM Final Report, Aug. 1977 - Mar. 1979
Richard R. Zeits Mar. 1979 100 p refs
(Contract DAAJ01-77-C-0777)
(AD-A075279; USAAVRDCOM-TR-79-15) Avail: NTIS HC A05/MF A01 CSCL 13/13

This report presents the results of a program to develop and evaluate a precision resin impregnation system. The program objective was to develop a resin impregnator capable of consistently wetting S-glass, Kevlar and graphite roving with resin controlled within plus or minus 2% by weight. The tests conducted demonstrate the ability of the developed equipment to meet resin content control objectives. The effect of the process variables of fiber temperature, resin temperature and winding speed on impregnation quality were evaluated. Short beam shear tests and microstructure analysis were the primary evaluation tests conducted. GRA

N80-17156# Research Inst. of National Defence, Linkoeping (Sweden).
SOME MECHANICAL AND CHEMICAL PROPERTIES OF BORON CARBIDES [INVERKAN AV BORKARBIDENS SAMMANSAATTNING PAA DGSS MEKANISKA EGENSKAPER]
Lars Ekbom and Gunnar Magnusson Apr. 1979 19 p refs In SWEDISH
(FOA-C-20301-F9) Avail: NTIS HC A02/MF A01

The chemical composition of boron carbides was studied in reference to the effects of the concentration of boron, silicon, and aluminum on its mechanical properties for use in light-weight armor. An increase in the concentration of boron improves sintering and reduces sintering temperatures as compared with conventional boron carbide. Small additions of silicon and aluminum reduce density and increase static resistance.
Author (ESA)

N80-17157# Research Inst. of National Defence, Linkoeping (Sweden).
INVESTIGATION OF SHAPES, SIZES, AND ELECTRICAL RESISTANCE OF FRAGMENTS OF CARBON FIBER COMPOSITES [UNDERSOEKNING AV FORM, STORLEK OCH ELEKTRISKT MOTSTAAND PAA FRAGMENT FRAAN KOLFIBERKOMPOSITER]
Tom Karlsson 1979 14 p refs In SWEDISH
(FOA-C-20304-F9) Avail: NTIS HC A02/MF A01

The carbon fiber composites Hercules 3501 and Fiberdux were tested. After filing, sawing, drilling, and grinding tests, the composite wastes were examined. The shape, size and electric resistance were studied. The size of particles varied from several millimeters to a few micro according to the test used. The shapes, which were classified into four categories, were found in various quantities in the wastes. The carbon particles are good electric conductors if a good contact is reached with sufficient pressure.
Author (ESA)

N80-17158# Fulmer Research Inst. Ltd., Stoke Poges (England).
THE SIGNIFICANCE OF DEFECTS IN CRFP BONDED HONEYCOMB STRUCTURES AND NON-DESTRUCTIVE TEST METHODS FOR THEIR DETECTION Final Report
R. L. Crocker and W. H. Bowyer May 1979 114 p refs
(Contract ESTEC-2922/76-NL-PP(SC))
(FRI-R736/4; ESA-CR(P)-1229) Avail: NTIS HC A06/MF A01

The identification of defects which occur in carbon fiber reinforced plastics skinned aluminum honeycomb sandwich materials was undertaken, along with an assessment of their significance in terms of mechanical properties. A range of defects was examined and all were shown to have significant effects on laminate strength. Available non-destructive test methods were reviewed and evaluated using specimens containing deliberately introduced defects. The optimum available nondestructive test procedure involves a combination of visual examination, roller probe coupled ultrasonics and X-radiography. The performance of other techniques including holographic interferometry, laser speckle pattern interferometry and thermography is discussed.
Author (ESA)

N80-17280 Naval Underwater Systems Center, Newport, R. I.
EXPERIMENTAL AND THEORETICAL DYNAMIC ANALYSIS OF CARBON-GRAPHITE COMPOSITE SHELLS
A. Harari and B. E. Sandman *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 33-37 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N80-17159 Cincinnati Univ., Ohio.
ADSORPTION OF POLAR MACROMOLECULES ONTO METALLIC SURFACES Ph.D. Thesis
Sun-Lin Chen 1979 112 p
Avail: Univ. Microfilms Order No. 8002426

Reflection-absorption infrared spectroscopy and ellipsometry were used to determine the structure of thin films, formed by adsorption of organic compounds onto iron and copper mirrors from solution. Results of the investigations suggest that: (1) the adsorption of 1-octadecanol may be due to the formation of hydrogen bonds to the surface; (2) the adsorption of dodecanoic acid may be due to the coordination of a carboxylate ion to a pair of metal atoms; and (3) the adsorption of dodecylamine and octadecanamide may be due to the coordination of -NH2 groups to metal atoms or the formation of hydrogen bonds to the surface. The adsorption of Epon 828 was also studied. Films about 15 A in thickness were formed on the metallic surface with a vertical conformation. The adsorption of higher molecular weight epoxies, Epon 1001 and Epon 1007, was also considered under the influence of solvents. Dissert. Abstr.

N80-17160 California Univ., Berkeley.
COMBUSTION AND STABILITY CHARACTERISTICS OF A PREMIXED VORTEX DOMINATED TWO DIMENSIONAL FLOW Ph.D. Thesis
Ahmad Reza Ganji 1979 305 p
Avail: Univ. Microfilms Order No. 8000350

A two dimensional combustion tunnel was constructed. A lean premixed turbulent propane/air flame was stabilized behind a rearward facing step. The following were studied: the existence and importance of large coherent structures in turbulent reacting and nonreacting free shear layers behind the step; the effect of inlet temperature and reference velocity on efficiency; CO, NO2 and NO sub x production in the flame; and the blowout and upstream propagation of the flame in this system. Dissert. Abstr.

N80-17161*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Chemistry.
CATALYSTS FOR ELECTROCHEMICAL GENERATION OF OXYGEN Final Report
P. Hagans and E. Yeager 31 Dec. 1979 168 p refs
(Grant NGR-36-027-050)
(NASA-CR-162757) Avail: NTIS HC A08/MF A01 CSCL 07D

Several aspects of the electrolytic evolution of oxygen for use in life support systems are analyzed including kinetic studies of various metal and nonmetal electrode materials, the formation of underpotential films on electrodes, and electrode surface morphology and the use of single crystal metals. In order to investigate the role of surface morphology to electrochemical reactions, a low energy electron diffraction and an Auger electron spectrometer are combined with an electrochemical thin-layer cell allowing initial characterization of the surface, reaction run, and then a comparative surface analysis. M.G.

N80-17162*# Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology.
THE INVESTIGATION OF TIME DEPENDENT FLAME STRUCTURE BY IONIZATION PROBES
J. M. P. Ventura, T. Suzuki, A. J. Yule, S. Ralph, and N. A. Chigier [1980] 23 p refs Sponsored in part by AFOSR, ONR and US Army
(Grant NsG-7517)
(NASA-CR-162766) Avail: NTIS HC A02/MF A01 CSCL 21B

Ionization probes were used to measure mean ionization current and frequency spectra, auto-correlations and cross-correlations in jet flames with variation in the initial Reynolds numbers and equivalence ratios. Special attention was paid to the transitional region between the burner exit plane and the plane of onset of turbulence. M.M.M.

N80-17163*# National Aeronautics and Space Administration, Washington, D. C.
CONCERNING A NEW CLASSIFICATION OF TRICYANIDES
F. Krafft and A. vonHansen Nov. 1979 13 p Transl. into ENGLISH from Ber. Deut. Chem. Ges. (West Germany), v. 22, 1889 p 803-811 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75504) Avail: NTIS HC A02/MF A01 CSCL 07D

A new classification series of tricyanides is presented. Several tricyanides are synthesized by a simple method from aluminum chloride, benzonitrile, and a respective alkyl or phenyl chloride, purified by recrystallization and distillation, and then analyzed. Structural formulae are suggested, and molecular weights, melting points, and boiling points are determined for each. Author

N80-17164# Virginia Univ., Charlottesville. Dept. of Chemistry.
TWO-DIMENSIONAL CORRELATED NUCLEAR MAGNETIC RESONANCE OF SPIN-COUPLED 11 B-1
David C. Finster, William C. Hutton, and Russell N. Grimes Oct. 1979 15 p refs
(Contract N00014-75-C-0305)
(AD-A076505; TR-32) Avail: NTIS HC A02/MF A01 CSCL 07/4

Two-dimensional (2D) Fourier transform nuclear magnetic resonance spectroscopy has been applied for the first time to a B11-H1 spin system. A heteronuclear experiment is performed on the closo-carborane, 2,4-C2B5H7, to give a 2D correlated spectrum in which chemical shift data of B11 and H1 are simultaneously displayed on a three-dimensional map. It is shown that the technique has the potential to resolve broad, overlapped B11 signals via the chemical shift of the protons to which they are scalar-coupled. GRA

N80-17165# Dayton Univ. Research Inst., Ohio.
COMBUSTION DIAGNOSTICS USING LASER SPONTANEOUS-RAMAN SCATTERING Final Report, 1 Jul. 1976 - 31 Oct. 1978
Perry Pappas Yaney Wright-Patterson AFB, Ohio AFAPL Apr. 1979 139 p refs
(Contract F33615-76-C-2078; AF Proj. 3048)
(AD-A076514; UDR-TR-79-46; AFAPL-TR-79-2035) Avail: NTIS HC A07/MF A01 CSCL 21/2

An existing computer-controlled Raman spectroscopy system, using a pulsed nitrogen laser and a double spectrometer, was upgraded and used to measure the temperatures in the combustion plume of an afterburning J85-5 turbojet engine. The computer-fitted temperatures had standard deviations between one and three percent. The agreement with simultaneous and sequential gas-sampling probe measurements and with sequential thermocouple measurements was within five percent. Upon completion of these studies, the system was extensively modified for use with a 10-inch diameter combustion tunnel. Forty-eight sets of Raman data were taken over a wide range of operating conditions of the tunnel. The temperatures ranged from 1000 to over 2000 K using methane fuel. The turbulent diffusion flame was characterized by an unsteady appearance and was orange-yellow in color. Poisson standard deviations for 21 of the measurements averaged four percent. Measurements and spectra of the laser-induced and non-laser-induced backgrounds were also obtained and analyzed. GRA

N80-17166# Naval Surface Weapons Center, White Oak, Md.
ION BEAM ANALYSIS OF Li-B ALLOYS Final Report
Donald G. Simons, David J. Land, Matt D. Brown, and James G. Brennan 1 Mar. 1979 20 p refs
(AD-A076137; NSWC/TR-79-95) Avail: NTIS HC A02/MF A01 CSCL 07/4

Proton backscatter analysis has been used to study lithium-boron residues which have been produced by a chemical process designed to extract the free lithium phase from lithium-boron alloys. On the two samples studied there is no evidence of the presence of Li on those surfaces which were in direct contact with the extraction chemicals. This depletion appears to be at least 3.5 microns deep. Measurements on the inside surfaces show that Li is present in a concentration which is in excess of the bound Li content of the samples. GRA

N80-17167# Sussex Univ., Brighton (England). School of Engineering and Applied Sciences.
DIRECT MEASUREMENT BY SECONDARY-ION MASS SPECTROMETRY OF SELF-DIFFUSION OF BORON IN Fe40Ni40B20 GLASS
R. W. Cahn, J. E. Evetts, J. Patterson, R. E. Samekh, and C. Kenway Jackson 1 Oct. 1979 20 p refs
(Grant N00014-78-G-0048)
(AD-A075782; TR-2) Avail: NTIS HC A02/MF A01 CSCL 07/4

The available methods for measuring diffusion rates of various metalloids in metallic glasses are critically reviewed, and the advantages of studying boron diffusion by secondary-ion mass-spectrometry (SIMS) set out. A surface coating of chemical composition similar to that of the glass but enriched in 10(B) was deposited on the polished glass by sputtering in an ultraclean environment. The samples were diffusion-annealed and profiled by SIMS. Subsequent tests showed that some samples had partly crystallized and these had anomalously low diffusion rates. GRA

N80-17168# Illinois Univ. at Urbana-Champaign.
REACTION OF CALCIUM SILICATES WITH CARBON DIOXIDE AND WATER Final Report, Jan. 1976 - Jan. 1979
R. L. Berger and J. Francis Young 26 Sep. 1979 38 p refs
(Grants DAAG29-76-G-0116; DAAG29-78-G-0049)
(AD-A075762; ARO-13031.3-MS) Avail: NTIS HC A03/MF A01 CSCL 07/4

The reaction of five calcium silicates with CO2 water was investigated. The calcium silicates differed in Ca/Si ratio or polymorphic type. Reaction kinetics were dependent on the Ca/Si ratio of the initial calcium silicates. Activation energy for the carbonation reaction ranged from 9.8 kcal/mole for Ca3SiO5 to 22.9 kcal/mole for CaSiO3. The reaction products were calcium carbonate (CaCO3) and a calcium silicate hydrate of variable stoichiometry. The Ca and H2O content of the calcium silicate hydrate product decreases with degree of reaction. This results in the final stable reaction products consisting of calcium carbonate and a highly polymerized hydrous silica gel which is insoluble in HCl. Calcite forms during the carbonation of Ca3SiO5, beta-Ca2SiO4, and gamma-Ca2SiO4 if free water is present. Aragonite forms in the absence of free H2O and in the carbonation of CaSiO3. The carbonation reaction decreases rapidly at CO2 pressures -0.12. At pressures from 0.12 to 54 atm the carbonation reaction increases, but at a slow rate. Temperature and relative humidity have significant influences on the rate of carbonation. GRA

N80-17169# ARO, Inc., Arnold Air Force Station, Tenn.
INTERAGENCY NITRIC OXIDE MEASUREMENT INVESTIGATION: AEDC RESULTS FOR PHASE 1. CALIBRATION TECHNIQUE FOR OPTICAL MEASUREMENT SYSTEM Final Report, Oct. 1977 - Aug. 1979
J. D. Few, H. S. Lowry, III, W. K. McGregor, and D. R. Keefer AEDC Oct. 1979 40 p refs
(AD-A077145; AEDC-TR-79-65) Avail: NTIS HC A03/MF A01 CSCL 07/2

As part of the continuing investigation to determine the cause of the differences that were formerly found to exist between nitric oxide (NO) concentrations measured with conventional sample extraction-gas analyzer techniques and with an ultraviolet (UV) spectroscopic technique, an experimental program was undertaken. The purpose of phase 1 of this program was to measure NO concentrations in several sources with known amounts of NO and over the range of temperatures from 300 to 2,000 K. Spectroscopic and probe measurements were obtained and compared over the test envelope. During this period, a discrepancy in the NO computer model used for reducing the data was identified and has since been corrected. Included in this report are the results of the optical measurements, a comparison of these results with the known concentrations, and a description of the new computer model. GRA

N80-17170# Michigan State Univ., East Lansing. Dept. of Chemistry.
TRIPLE QUADRUPOLE MASS SPECTROMETRY FOR DIRECT MIXTURE ANALYSIS AND STRUCTURE ELUCIDATION Interim Report
R. A. Yost (Florida Univ., Gainesville) and C. G. Enke Oct. 1979 30 p refs
(Contract N00014-76-C-1092)
(AD-A075254; TR-3) Avail: NTIS HC A03/MF A01 CSCL 07/4

The triple quadrupole mass spectrometer is shown to be a simple and highly efficient system for the observation of the fragmentation pattern of selected ions. The instrument consists of, in series, a CI/EI ion source, a quadrupole mass filter, an RF-only quadrupole collision chamber, a second mass filter, and an electron multiplier. The high sensitivity of the MS/MS technique with quadrupoles depends particularly on the highly efficient low energy collision-induced dissociation process in the strong focusing RF quadrupole field. Detection limits for methane and nitrobenzene of 10 to the minus 15 mole are shown. Analysis of a mixture of six components, including two isomers and an isobaric compound is presented. Chemical noise is virtually eliminated by the selection of both parent and fragment ion. An application of the system for structure elucidation is also described. GRA

N80-17171# Michigan State Univ., East Lansing. Dept. of Chemistry.
THE FRAGMENTATION OF THE IONS OF NONAN-4-ONE: A STUDY BY TRIPLE QUADRUPOLE MASS SPECTROMETRY Interim Report
R. A. Yost (Florida Univ., Gainesville) and C. G. Enke 3 Oct. 1979 21 p refs Submitted for publication
(Contract N00014-76-C-1092)
(AD-A075255; TR-4) Avail: NTIS HC A02/MF A01 CSCL 07/4

The fragmentation of the ions of the compound nonan-4-one were studied in detail with low-energy collision-induced dissociation (CID) in a triple quadrupole mass spectrometer. Ions of the sample molecule created in an EI source are mass selected by a quadrupole mass filter, dissociated by low-energy collision with neutral molecules in a quadrupole collision chamber, and the dissociation products are mass-selected by a second quadrupole mass analyzer. The normal EI mass spectrum of nonan-4-one shows 47 fragment ions. A fragmentation spectrum is obtained for each of the ions from the EI source. The result is the positive identification of over 400 parent-daughter pairs. This compares with a total of 47 observed pairs (37 confirmed) from all previous metastable ion studies. Normal alkanone fragmentations are observed: Alpha-cleavage, loss of CO or C2H4 from Alpha-cleavage ions, and McLafferty rearrangement in the long chain. The relative abundances of the short chain and long chain Alpha-cleavage fragments are demonstrated to depend on the fragmentation energy available with the long chain fragment predominating at lower energies. The fragmentations observed are grouped for discussion. A number of parent-daughter structures and fragmentation mechanisms are confirmed and some new ones are proposed. New graphical representations of the fragmentation patterns have been devised to accommodate the large amount of information produced in this study. GRA

N80-17172# Pennsylvania State Univ., University Park. Dept. of Chemistry.
SYNTHESIS OF TETRANUCLEAR MIXED-METAL CLUSTERS VIA THE REACTION OF CO(CO4) WITH CLOSED METAL CARBONYL TRIMERS. CRYSTAL AND MOLECULAR STRUCTURE OF (PH3P)2N CORU3(CO13) Interim Report
Paul C. Steinhardt, Wayne L. Gladfelter, A. Dale Harley, Joseph R. Fox, and Gregory L. Geoffroy 3 Oct. 1979 40 p refs Submitted for publication
(Contract N00014-77-C-0417; NR Proj. 053-645)
(AD-A075264; TR-79-2) Avail: NTIS HC A03/MF A01 CSCL 07/2

The clusters HCoRu3(CO)13, HCoRu2Os(CO)13, HCoRuOs2 (CO)13, and HCoOs3(CO)13 were synthesized by allowing K(CO(CO)X4) to react with Ru3(CO)12, Ru2Os(CO)12, RuOs2 (CO)12 and Os3(CO)12, respectively, followed by protonation. Reaction of K(Co(CO)4) with Fe3(CO)12, Fe2Ru(CO)12, and FeRu2(CO)12 followed by acidification did not lead to the desired hybrido mixed metal clusters but instead to various other products. Reaction of (PPN)(Co(CO)4) (PPN = (Ph3P)2N) with Fe3(CO)12 and Ru3(CO)12 without subsequent acidification gave the salts (PPN) (CoFe3(CO)13) and (PPN)(CoRu3(CO)13). The latter was structurally characterized by single crystal X-ray diffraction. It crystallizes in the space group Pi with Z = 2 and unit cell dimensions a = 9.783(5) angstroms, b = 14.768(5) angstroms c = 18.675(5), alpha = 110.39(3) degrees, beta = 99.02(4) degrees, gamma = 91.44(4) degrees, and V = 2489(4) angstroms cubed. Other significant observations are reported.
R.C.T.

N80-17173# SRI International Corp., Menlo Park, Calif.
NITROUS ACID AS AN OXIDANT IN ACIDIC MEDIA Final Report, 15 Jul. 1976 - 31 May 1979
David S. Ross and Georgina P. Hum 25 Sep. 1979 21 p refs
(Contract DAAG29-76-C-0060)
(AD-A075263; ARO-13754.2-CX) Avail: NTIS HC A02/MF A01 CSCL 07/2

It has been found that benzyl and aliphatic alcohols are rapidly oxidized by nitrous acid to the corresponding carbonyl compound at 25 degrees C in 50-70% sulfuric acid. The oxidations are very rapid, complete within minutes for most substrates; the process appears to be quantitative, at least in runs with alcohol concentrations in the 10 to the -14 M range. For the benzyl alcohols, an electron withdrawing para-substituent, such as nitro, retards the rate, while an electron donating group, such as methyl, increases the rate. Thus, some cationic character must be present in the process. The rate increases with increasing acidity, peaking at 60% sulfuric acid, and declining thereafter. Surprisingly, ethers are oxidized as well, with the most unlikely case, the methyl ether of 2-phenyl-2-propanol, cleanly and rapidly yielding acetophenone. For primary and secondary alcohols and their ethers, the proposed mechanism for oxidation includes initial electrophilic attack by NO- on oxygen, followed by elimination of HNO. In these cases, the nitrous acid is regenerated, probably through HNO oxidation by dissolved oxygen. Thus, an equivalent of nitrous acid oxidizes more than one equivalent of alcohol. For the tertiary alcohol case, we suggest elimination of alkyl nitrite; however, the mechanistic details remain to be fully established. GRA

N80-17174# Materials Research Labs., Ascot Vale (Australia).
LOW INTENSITY, LONG DURATION CHEMILUMINESCENT SYSTEMS. PART 2: CHEMILUMINESCENCE FROM BIS2, 4-DICHLORO-6-CARBOALKOXYPHENYL OXALATES
Christopher D. Dowd and D. Brenton Paul Jan. 1979 35 p refs
(AD-A073142; MRL-R-737-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 07/4

Various oxalate esters have been synthesised and their chemiluminescent emission examined in an attempt to produce an improved low intensity, disposable lighting device suitable for 10 hours operation. Derivatives of the bis(2-carboalkoxy-4,6-dinitrophenyl)oxalate series were shown to possess unsuitable stability while the chemiluminescence of the bis(6-carboalkoxy-2,4,5-trichlorophenyl)oxalates was too intense to modify suitably. A number of bis(6-carboalkoxy-2,4-dichlorophenyl)oxalates were prepared and by treatment with various combinations of catalyst and inhibitor satisfactory low intensity light emission could be achieved after a 5 minute induction period. Optimum conditions were: oxalate ester, 2 x 10(-2)M; H2O2, 2 x 10(-2)M; potassium salicylates, 5 x 10(-4M); oxalic acid, 10(-4M). The storage stabilities and solubilities of the dichloro series of oxalates were superior to those of 2,4,6-TCPO. Aspects of the synthesis of the substituted salicylic acid precursors to the oxalates are discussed. The merits of chemiluminescent systems relative to beta lights are considered for the particular case of low level illumination. GRA

N80-17175# Sandia Labs., Livermore, Calif. Materials Development Div.
PLATING ON TITANIUM FOR ELECTROCHEMICAL JOIN-

ING APPLICATIONS
J. W. Dini and H. R. Johnson Sep. 1979 21 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8038) Avail: NTIS HC A02/MF A01

Ring shear tests were used to evaluate the adhesion of electroplated nickel on titanium. Different plating processes were investigated. Shear strengths as high as 299 MN/sq m (43,300 psi) were obtained. By utilizing the best processes as indicated from these tests, some titanium parts with machined tapers were then successfully joined to one another and to a uranium alloy (mulberry) with thick nickel plating. DOE

N80-17176# Los Alamos Scientific Lab., N. Mex.
ELUCIDATION OF GEOMATRICES BY LASER PYROLYSIS/GAS CHROMATOGRAPHY AND PYROLYSIS/MASS SPECTROMETRY
C. E. R. Jones and N. E. Vanderborgh 1979 22 p refs
Presented at the Intern. Symp. on Advances in Chromatography, Lausanne, Switzerland, 24 Sep. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1147; CONF-790931-1) Avail: NTIS HC A02/MF A01

Presented methods for the examination of organics entrained in geological matrices are tedious even if not fallible. Thermal degradative techniques combined with the separatory power of a gas chromatographic column or a quadrupole mass spectrometer operating low-voltage electron impact model afford rapid access to detailed profiles of such materials. The virtue of these parallel approaches are compared and contrasted in application to the elucidation of Devonian Shale and other geological material. DOE

N80-17177# Ames Lab., Iowa. Dept. of Chemistry.
NEUTRON-CAPTURE GAMMA-RAY ANALYSIS OF COAL FOR SULFUR, IRON, SILICON AND MOISTURE Ph.D. Thesis
D. A. Fay May 1979 135 p refs
(Contract W-7405-eng-82)
(IS-T-847) Avail: NTIS HC A07/MF A01

Samples of coal weighing approximately 200 grams placed in a collimated beam of neutrons from the thermal column of the Ames Laboratory Research Reactor produced capture gamma-rays which could be used for the simultaneous determination of sulfur and iron. Spectra from NaI(Tl) and Ge(Li) detectors were used and interferences were located by examining spectra of the major elemental components of coal. In determining sulfur, iron is a potential source of interference when gamma-ray spectra are collected with a NaI(Tl) detector. Corrections for iron interference were made by use of a higher energy iron peak. The possibility of determining silicon in coal was investigated but this element determination was unsuccessful since capture gamma-ray spectrometry lacked the necessary sensitivity for silicon. A linear relation was found between the area of the hydrogen capture peak at 2.23 MeV and the amount of water added to coal. DOE

N80-17178# Centre Technique des Industries Mecaniques, Senlis (France).
THE ELECTRODEPOSITION OF CHROME ON STEEL ALLOYS. DEVELOPMENT OF AN ELECTROCHEMICAL METHOD FOR CHARACTERIZING TREATED SURFACES BEFORE PLATING Final Report [DEPOT DU CHROME DUR SUR LES ACIERS ALLIES MISE - AU POINT D'UNE METHODE ELECTROCHEMIQUE DE CARACTERISATION DES PREPARATIONS DE SURFACE AVANT CHROMAGE]
Mortier and Fuvelle 30 Jan. 1979 32 p refs In FRENCH
(CETIM-1-2F-08-0) Avail: NTIS HC A04/MF A01

Surface treatment in preparation for chromium electroplating is discussed. The plating of 16 NC 6 cementite, a stainless steel, and two carbon steels, XC 38 and XC 100, is examined. An electrochemical method for determining the suitability of a metallic surface to electrodeposition is demonstrated. Fatigue tests on the plated surfaces are discussed. The surface treatment is examined in relation to the reduction of current density during electroplating. Author (ESA)

N80-17179# National Physical Lab., Teddington (England). Div. of Chemical Standards.
PHYSICAL CONSTANTS OF SOME CONSTITUENTS OF COAL TAR
E. F. G. Herington Jun. 1979 10 p refs
(NPL-Chem-102) Avail: NTIS HC A02/MF A01

A table of physiochemical properties of coal tar is given. The numerical values, which are expressed in the International System of Units, were extracted from up-to-date sources and include the results of precise measurements made in the Division of Chemical Standards, of the National Physics Laboratory. Author (ESA)

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-17180 Wisconsin Univ. - Madison.
NON-METALLIC INCLUSIONS IN MAGNESIUM-TREATED IRONS Ph.D. Thesis
Charles Ching-en Wang 1979 288 p
Avail: Univ. Microfilms Order No. 7924197

Effects of magnesium treatment and post-inoculation on non-metallic inclusions in hypereutectic ductile irons were studied by investigating: (1) chemical changes in the melt; (2) generation of non-metallic inclusions after the two treatments; (3) microstructural changes; (4) the phenomenon of magnesium and inoculation fade; and (5) the role of inclusions as heterogeneous nucleating particles in the process of spheroidal graphite nucleation. All tests were carried out on magnesium-treated melts held at 2550 F to 2600 F for 40 to 90 minutes and then post-inoculated. Holding took place under an atmosphere of natural gas with the reaction products left in contact with the melt. It is concluded that any kinds of inclusions may serve as nuclei for spheroidal graphite and the efficiency of nodule formation is controlled by both inclusions and melt conditions. Dissert. Abstr.

N80-17181 Stevens Inst. of Tech., Hoboken, N. J.
STRUCTURE AND STRESS OF EPITAXIAL GOLD ELECTRODEPOSITS ON COPPER AND SILVER SUBSTRATES Ph.D. Thesis
Srinivas T. Rao 1979 140 p
Avail: Univ. Microfilms Order No. 7925056

The effect of a substrate and an additive on the surface and internal stress of thin epitaxially electrodeposited gold was studied. The substrates were rolled recrystallized copper and silver sheets with a texture such that planes were predominantly parallel to the surface. The internal stresses were determined from the force exerted by an electrobalance to offset the bending of the substrate plated on only one side. Additional experiments were performed in which the deposition was interrupted after a gold layer had covered the substrate. To determine the cause of an initial force application by the electrobalance prior to gold deposition, experiments in an electrolyte in which sodium ions were substituted for gold were performed. The internal stress was also measured after a deliberate replacement reaction between replacement reaction between copper and gold had been permitted to occur. Dissert. Abstr.

N80-17182 Rutgers - The State Univ., New Brunswick, N. J.
SURFACE LAYER AND BULK PLASTICITY OF TENSILE DEFORMED AND FATIGUE CYCLED METALS AND PREDICTION OF FATIGUE LIFE BY X-RAY DIFFRACTION Ph.D. Thesis
Robert Northrup Pangborn 1979 250 p
Avail: Univ. Microfilms Order No. 7928435

X-ray double crystal diffractometry and reflection topography were employed to examine the deformation response of single crystals and Al 2024 alloys specimens. A propensity for preferential work hardening of the surface layers compared to the bulk material was demonstrated for both tensile deformed and fatigue cycled metals. The cyclically induced defect distribution with depth from the specimen surface was also investigated as a function of the fraction of fatigue life. The excess dislocation density of grains located up to 300 micron in depth was examined using molybdenum radiation, and found to vary linearly with the fatigue life. This steep linear dependence, in conjunction with the early life saturation behavior of surface grain densities measured with copper radiation, provided a new criterion for predicting accurately the fatigue life and failure. Dissert. Abstr.

N80-17183 Ohio State Univ., Columbus.
ELECTROCHEMICAL STUDIES OF Ni, Cr, Fe AND STRESS CORROSION CRACKING OF Ni-Cr-Fe ALLOYS BY FAST STRAIN RATE TEST IN CONCENTRATED Na OH AT ELEVATED TEMPERATURES Ph.D. Thesis
Uh-Chul Kim 1978 320 p
Avail: Univ. Microfilms Order No. 7922509

A reaction mechanism as well as short term and relatively long term corrosion rates were found for the corrosion of nickel at controlled potentials. Some data for Cr and Fe were also compared with the data for Ni. Crack propagation rates were measured for Nickel 200 and for AISI 304L stainless steel. Annealed AISI 304L, sensitized AISI 304L and annealed AISI 304L with inhibitor were studied. These data were compared with the data for Incoloy 800 and for Inconel 600 after other workers. Results are discussed and conclusions drawn.
Dissert. Abstr.

N80-17184 Ohio State Univ., Columbus.
CORROSION OF METALS BY LIQUID SODIUM-CARBONATE Ph.D. Thesis
Randy Carl John 1979 213 p
Avail: Univ. Microfilms Order No. 8001756

The corrosion of metals by liquid Na2CO3 was studied using electrochemical probes for O2 and Na to correlate the solubilities of NiCO3, Na2NiO2, and NaAlO2 to the salt basicity. These solubilities were correlated to TGA-measured kinetics of metallic coupons coated with thin films of Na2CO3. The solubility and kinetic measurements were then compared to free corrosion measurements of alloys covered with thin salt films in which the chemistries of the oxide/melt and melt/gas interfaces were monitored electrochemically with increasing time. The conclusions of this study are that Na2CO3 coatings can increase or decrease the corrosion rates of alloys, as compared to oxidation. Alloys covered with films which are very soluble in the salt (e.g., Cr2O3 and SiO2) experience accelerated attack in the presence of Na2CO3. On the other hand, alloys covered with films insoluble in the salt (e.g., Al2O3 and NiO) undergo reduced attack when coated with the salt. Dissert. Abstr.

N80-17185 Case Western Reserve Univ., Cleveland, Ohio.
THE DESIGN OF AN ACIDIFIED NaCl ENVIRONMENT FOR THE STUDY OF THE EFFECT OF DEFORMATION ON THE STRESS CORROSION CRACKING OF A 301 AUSTENITIC STAINLESS STEEL Ph.D. Thesis
Erederick Paul Vaccaro 1979 222 p
Avail: Univ. Microfilms Order No. 8001481

A solution, composed of 4.9 M NaCl, .15 M Na2SO4 was acidified at a pH approximately .7 with 3.0 ml HCl/1t. Although lower concentration NaCl solutions often display active passive behavior, even under acidified conditions, stress corrosion cracking (SCC) did not occur in short times (less than 100 hours). Acidification initially activates the alloy and a thick film composed of insoluble corrosion products develops. These products were shown to be primarily Cr enriched, Fe and Ni depleted, and contained Cl and S. At either a critical thickness, structure, or composition, a uniquely rapid transformation occurs resulting in a pseudo passive film which is highly susceptible to localized corrosion and SCC. All deformation conditions increase sensitivity to SCC when the criterion for comparison is the percent yield strength. Dissert. Abstr.

N80-17186 California Univ., Berkeley.
THE MICROSTRUCTURE, MECHANICAL PROPERTIES, AND TWO-BODY ABRASIVE WEAR RESISTANCE OF MODIFIED SECONDARY HARDENING STEELS Ph.D. Thesis
Thomas A. Lechtenberg 1979 135 p
Avail: Univ. Microfilms Order No. 8000415

A study of the alloy system presented led to the development of a new composition (Fe-0.4C-4Cr-2Mo-1W-0.5V) which had, at the same hardness as the base steel, a much higher impact toughness (55Rc, 40 ft-lbs). A microstructural analysis showed that there are two types of carbides which precipitate upon tempering and are responsible for the secondary hardening. These were identified as an M2C carbide at 500 C and an MC carbide at 575 C. Two-body abrasive wear rates were measured and it was found that the commercial steel composition with large undissolved M23C6 carbides exhibited the lowest wear rates. The modified steels had wear rates about 10-15% higher at similar hardness levels. At similar yield strengths, the lowest wear rates were obtained in the presence of cubic MC carbides in the microstructure. Dissert. Abstr.

N80-17187 California Univ., Berkeley.
FUNDAMENTAL INVESTIGATION OF CONTINUOUS PRECIPITATION IN AN Fe-Nb CREEP RESISTANT ALLOY Ph.D. Thesis
John Arthur Wert 1979 145 p
Avail: Univ. Microfilms Order No. 8000561

An extensive study was made of the precipitation behavior of an Fe-1.7 at.% Nb alloy quenched from the delta phase field. The first step in the decomposition reaction is thought to occur by clustering of Nb atoms in the ferrite matrix, similar to the clustering of Mo atoms which is known to occur during aging of Fe-Mo alloys. The precipitate-free zones were formed by solute depletion in the vicinity of the grain boundary and the subsequent difficulty of nucleation of the Fe2Nb precipitates in the regions of lowered solute concentration. Using two-step aging treatments, an initial low temperature step to develop the Nb atom clusters followed by a higher temperature step to cause Fe2Nb precipitation, the precipitate-free zones were eliminated. The origin of this effect is though to be nucleation of Fe2Nb precipitates on the clusters developed during the initial aging step. Dissert. Abstr.

N80-17188 Case Western Reserve Univ., Cleveland, Ohio.
MECHANISMS OF PINHOLE FORMATION IN GRAY IRON Ph.D. Thesis
Baltasar Hernandez-Reyes 1979 66 p
Avail: Univ. Microfilms Order No. 8001458

The influence of selected additions on the surface tension of molten iron for gray iron castings was determined and the effect that this surface tension exerted on the pinhole susceptibility of the gray iron cast into green sand molds was determined. The surface tension was measured by determining the pressure developed by a high purity argon gas bubble from a ceramic capillary tube immersed in the molten iron. The additions to the molten iron studied were aluminum, sulfur, titanium, tellurium, iron oxide pellets, rare earths, selenium and phosphorus. The pinhole susceptibility was significantly affected by the surface tension. High surface tensions above a specific line drawn through a surface tension temperature plot did not exhibit pinholes in green sand molds. The surface tension of molten iron was lowered significantly by the temperature and any measurements have to normalize this temperature effect in evaluating susceptibility to pinholing. Dissert. Abstr.

N80-17189 Ohio State Univ., Columbus.
SPECIFIC ENERGIES FOR FRACTURE ON ALPHA-BETA PHASE INTERFACES IN TITANIUM-MOLYBDENUM SYSTEM Ph.D. Thesis
James Arthur Hall 1979 158 p
Avail: Univ. Microfilms Order No. 8001740

Energy per unit fracture surface area, consumed in the fracture of titanium-molybdenum alloys along alpha-beta interfaces, was studied in order to improve the understanding of fracture behavior of two phase titanium alloys which are known often to favor the phase interface as crack initiation sites or fracture paths. The nature of the composition profile in the immediate vicinity of the phase interface which included the composition gradient, g, and the beta phase composition at the interface, N sub alpha/Beta were studied. Both equilibrium and nonequilibrium profiles obtained by equilibration anneals as modified by subsequent up-quench or down-quench treatment were studied.
Dissert. Abstr.

N80-17190 Michigan Technological Univ., Houghton.
THE EFFECTS OF BISMUTH SEGREGATION ON THE GRAIN BOUNDARY DIFFUSION OF NICKEL IN COPPER Ph.D. Thesis
Stephen P. Clough 1977 98 p

Avail: Univ. Microfilms Order No. 8001316

The grain boundary diffusion of nickel at 530 C in dilute copper - bismuth alloys was studied. Grain boundary chemistry was monitored by Auger electron spectroscopic analysis of intergranular fracture surfaces. The prior segregation of bismuth to the copper grain boundaries was found to lower the grain boundary diffusivity of nickel by over an order of magnitude at 530 C. Equal concentrations of nickel and bismuth were found on the fracture surfaces. A classical thermodynamic argument, developed to explain temper embrittlement in low alloy steels, was used to predict the formation of a two dimensional grain boundary compound of nickel and bismuth. The theory developed attributes the decrease in the grain boundary diffusivity of nickel to the formation of the compound. Possible applications of the theory are discussed. Dissert. Abstr.

N80-17191 California Univ., Berkeley.

PRECIPITATION HARDENING IN Fe-Ni BASE AUSTENITIC ALLOYS Ph.D. Thesis

Keh-Minn Chang 1979 105 p

Avail: Univ. Microfilms Order No. 8000305

The precipitation of metastable Ni3X phases in the austenitic Fe-Ni-base alloys is investigated by using various combinations of hardening elements, including Ti, Ta, Al, and Nb. The theoretical background on the formation of the L1 sub 2 type and D0 sub 22 type transition precipitates is summarized, and a model for their appearance is proposed from an analysis of static concentration waves ordering the fcc lattice. The aging behavior of these alloys is studied over the temperature range of 500 C to 900 C. Typical hardness curves show a substantial hardening effect due to precipitation. An excellent combination of strength and fracture toughness can be developed by employing double aging techniques. It is also shown that the addition of Cr retards the aging kinetics of the precipitation reactions and suppresses intergranular embrittlement. Dissert. Abstr.

N80-17192 Michigan Technological Univ., Houghton.

THERMODYNAMICS AND KINETICS OF THE PROEUTECTOID FERRITE TRANSFORMATION IN Fe-C AND Fe-C-X ALLOYS Ph.D. Thesis

John Robert Bradley 1977 126 p

Avail: Univ. Microfilms Order No. 8001315

Three models of the statistical thermodynamics of interstitial solid solutions are used to reevaluate the thermodynamics of the proeutectoid ferrite reaction. Thickening and lengthening kinetics of proeutectoid ferrite allotriomorphs are measured as a function of isothermal transformation temperature in several Fe-C-X alloys where X = Si, Ni, Mn and Cr. Resulting parabolic growth rate constants are compared to values calculated on the basis of three models: local equilibrium at alpha:gamma boundaries with partition of X, local equilibrium with 'pile-up' of X rather than bulk partition, and paraequilibrium. Values calculated from the paraequilibrium model are in best agreement with the experimental values. Dissert. Abstr.

N80-17193 Cincinnati Univ., Ohio.

CORRELATION OF SUBSTRUCTURE AND CRACK BEHAVIOR WITH CREEP-FATIGUE PROPERTIES OF 304 STAINLESS STEEL Ph.D. Thesis

August Martin Ermi 1979 233 p

Avail: Univ. Microfilms Order No. 8002106

Transmission and scanning electron microscopy were employed to study the substructure and cracking behavior of AISI 304 stainless steel tested at elevated temperatures in low-cycle fatigue with various hold times. Parameters such as cell size, misorientation angle, precipitates, the number of cycles to initiate a crack, and crack growth rate were evaluated and discussed in terms of fatigue properties and creep and environment effects. A 304 SS reference heat showed that the cell size was inversely related to the relaxed tensile saturation stress, but at the lower strain rate, substructures tended to resemble that of pure creep. A second heat of 304 SS, which displayed significant resistance to fatigue damage for tension holds, was compared to the standard heat. The improved fatigue life was attributed to differences in grain size and grain boundary precipitate morphology. Dissert. Abstr.

N80-17194 California Univ., Berkeley.

MICROSTRUCTURES AND PHASE TRANSFORMATIONS IN INTERSTITIAL ALLOYS OF TANTALUM Ph.D. Thesis

Ulrich Dahmen 1979 134 p

Avail: Univ. Microfilms Order No. 8000320

Electron microscopy and ultrahigh vacuum technology were used to examine the microstructures and phase transformations in dilute interstitial tantalum carbon alloys. Through a number of control experiments, the role and sources of interstitial contamination in the alloy preparation (and under operating conditions) are revealed. It is demonstrated that all previously published work on the dilute interstitially ordered phase Ta64C can be explained consistently in terms of ordering of the interstitial contaminants oxygen and hydrogen, leading to the formation of the phases Ta12O and Ta2H. Dissert. Abstr.

N80-17195 Michigan Technological Univ., Houghton.

INTERFACIAL REACTIVITY AND STRESS CORROSION CRACKING OF SOME COPPER ALLOYS IN ACIDIC ENVIRONMENTS Ph.D. Thesis

Timothy R. Pinchback 1977 163 p

Avail: Univ. Microfilms Order No. 8001317

The roles of bulk electrolyte composition and alloy solute segregation in controlling localized corrosion and SCC susceptibility were determined. The materials studied included a tin bearing commercial admiralty brass and high purity binary alloys of Cu-Sn, Cu-Sb, and Cu-Bi. SCC mechanisms are proposed based on determinations of crack kinetics, crack morphology, fracture surface chemistry, solution analysis and alloy polarization characteristics. The variables that determine localized corrosion tendency and crack initiation are alloy solute content, segregation and stress. The relative effects of these parameters are discussed. A mechanism for crack propagation based on strain enhanced dissolution at segregated grain boundaries is presented. Dissert. Abstr.

N80-17196 Michigan Technological Univ., Houghton.

CHARACTERIZATION OF GAS BUBBLES INJECTED INTO LIQUID METALS AND THE KINETICS OF GASEOUS DEOXIDATION OF LIQUID COPPER Ph.D. Thesis

Rockne James Andreini 1976 196 p

Avail: Univ. Microfilms Order No. 8001312

Liquid metals under laminar flow at the orifice were studied as argon or carbon monoxide bubbles were injected into the surface. An experimental approach, which utilized the noises generated by bubbles, was used to collect the necessary data. Tin, lead, and copper melts were investigated. Gas bubble formation frequencies (and hence bubble size) were determined, and it was found that the bubble size generated for a particular orifice diameter was dependent upon the magnitudes of the orifice Froude and Weber numbers. Drag coefficients of the rising bubbles were found to agree well with data previously generated in aqueous solution systems. Bubble size and velocities were determined in akinetic study of gaseous deoxidation of liquid copper with carbon monoxide and reformed natural gas as the reducing gases. The deoxidation kinetics utilizing carbon monoxide are determined primarily by the mass transport of oxygen in liquid copper. Dissert. Abstr.

N80-17197 Stanford Univ., Calif.

TWO THEORETICAL STUDIES OF FRACTURE AND DEFORMATION OF METALS Ph.D. Thesis

George Mathews Pharr, IV 1979 176 p

Avail: Univ. Microfilms Order No. 8001991

The growth of grain boundary cavities is examined using a mechanism in which atoms are driven by gradients in curvature along the surface of the cavity to the grain boundary. Particular attention is given to following the time dependent shape evolution of an initially lenticular cavity. Taking this approach allows for the determination of the effects of capillarity and transients on the growth process. The cavity evolution is examined using a finite difference numerical scheme in which the displacements of discrete points on the cavity surface are followed in time. An array of cavities is studied to determine the effects of cavity interaction on the growth process and to define a criterion for fracture. Low temperature plastic deformation is also examined and a dislocation dynamical model for low temperature plastic

flow is developed from the Taylor-Orowan equation.
Dissert. Abstr.

N80-17198 Yeshiva Univ., New York, N. Y.
COMPUTER SIMULATION STUDIES OF BINARY ALLOYS Ph.D. Thesis
Mohan Kumar Phani 1979 163 p
Avail: Univ. Microfilms Order No. 8001276

A Monte Carlo simulation of a binary alloy on a simple cubic and plane square lattices is presented. The system with 27,000 sites and equal number of A and B atoms is quenched from an infinite temperature to a temperature T = 0.6T sub c and the time evaluation of the long range and short range order parameters and structure functions are studied. The antiphase domains are seen to play an important role in the kinetics. The binary alloy on a fcc lattice with nearest and next nearest neighbor interactions is treated by Monte Carlo. The energy, sublattice magnetization and specific heat (energy fluctuation) are calculated. The phase diagram in the T-alpha plane is calculated for the equicomposition alloy. For the alpha as it approaches infinity point the extrapolated value is approximately 1 percent higher than the known series expansion result. Dissert. Abstr.

N80-17199*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHEMICAL PROCESSES INVOLVED IN THE INITIATION OF HOT CORROSION OF B-1900 AND NASA-TRW VIA
George C. Fryburg, Fred J. Kohl, and Carl A. Stearns 1979 49 p refs Presented at 165th Meeting of the Electrochem. Soc., Los Angeles, 14-19 Oct. 1979
(NASA-TM-81399; E-308) Avail: NTIS HC A03/MF A01 CSCL 11F

Sodium sulfate induced hot corrosion of B-1900 and NASA-TRW VIA at 900 C was studied with special emphasis on the chemical reactions occurring during and immediately after the induction period. Thermogravimetric tests were run for set periods of time after which the samples were washed with water and water soluable metal salts and/or residual sulfates were analyzed chemically. Element distributions within the oxide layer were obtained from electron microprobe X-ray micrographs. A third set of samples were subjected to surface analysis by X-ray photoelectron spectroscopy. Evolution of SO2 was monitored throughout many of the hot corrosion tests. Results are interpreted in terms of acid-base fluxing mechanisms. K.L.

N80-17200*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANISOTROPY OF NICKEL-BASE SUPERALLOY SINGLE CRYSTALS
Rebecca A. MacKay (Case Western Reserve Univ., Cleveland), Robert L. Dreshfield, and Ralph D. Maier (Case Western Reserve Univ., Cleveland) 1980 17 p refs Prepared for Presentation at 4th Intern. Symp. on Superalloys, Champion, Pa., 21-25 Sep. 1980
(NASA-TM-81437; E-327) Avail: NTIS HC A02/MF A01 CSCL 11F

The influence of orientation on the tensile and stress rupture behavior of 52 Mar-M247 single crystals was studied. Tensile tests were performed at temperatures between 23 and 1093 C; stress rupture behavior was examined between 760 and 1038 C. The mechanical behavior of the single crystals was rationalized on the basis of the Schmid factor contours for the operative slip systems and the lattice rotations which the crystals underwent during deformation. The tensile properties correlated well with the appropriate Schmid factor contours. The stress rupture lives at lower testing temperatures were greatly influenced by the lattice rotations required to produce cross slip. A unified analysis was attained for the stress rupture life data generated for the Mar-M247 single crystals at 760 and 774 C under a stress of 724 MPa and the data reported for Mar-M200 single crystals tested at 760 C under a stress of 689 MPa. Based on this analysis, the stereographic triangle was divided into several regions which were rank ordered according to stress rupture life for this temperature regime. Author

N80-17201*# National Aeronautics and Space Administration, Washington, D. C.
MICROSTRUCTURE AND MECHANICAL PROPERTIES OF HIP-CONSOLIDATED RENE 95 POWDERS
Y. Shimanuki, Y. Nishino, M. Masui, and H. Doi Feb. 1980 15 p refs Transl. into ENGLISH from J. Jap. Soc. Powder Met. (Japan), v. 25, no. 8, Dec. 1978, p 262-267 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75759) Avail: NTIS HC A02/MF A01 CSCL 11F

The effects of heat-treatments on the microstructure of P/M Rene 95 (a nickel-based powder metal), consolidated by the hot-isostatic pressing (HIP), were examined. The microstructure of as-HIP'd specimen was characterized by highly serrated grain boundaries. Mechanical tests and microstructural observations reveal that the serrated grain boundaries improved ductility at both room and elevated temperatures by retarding crack propagation along grain boundaries. Author

N80-17202# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Metallurgy and Materials Science.
PHASE TRANSFORMATIONS AND TENSILE PROPERTIES OF Ti-10V-2Fe-3Al
T. W. Duerig, G. T. Terlinde, and J. C. Williams Aug. 1979 39 p refs
(Contract N00014-76-C-0409)
(AD-A074093; JWTR-5) Avail: NTIS HC A03/MF A01 CSCL 11/6

The effect of heat treatment on the microstructure of the metastable beta alloy Ti-10V-2Fe-3Al has been studied using light and electron metallography, analytical electron microscopy, and X-ray diffraction. A limited survey of the effect of microstructure on tensile properties of the alloy also has been conducted. It has been found that the alloy contains inclusions which are rich in Ti, S, Si, and P. The alloy has been shown to form the omega phase both athermally and isothermally. The isothermal omega can have either an ellipsoidal or a cuboidal morphology. The reasons for this are enumerated. The formation of the equilibrium alpha phase has been studied, and three distinct modes of formation are described. A stress induced othorhombic martensite also has been observed. The effect of this stress induced product on tensile behavior is discussed. The relative roles of inclusions and alpha phase precipitates on tensile fracture also have been examined. GRA

N80-17203# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
PHOTOACTIVATION OF COBALT CARBONYL CATALYST: GENERATION OF REACTIVE MONONUCLEAR FRAGMENTS FROM DINUCLEAR, METAL-METAL BONDED COMPLEXES
Carol L. Reichel and Mark S. Wrighton 12 Sep. 1979 16 p refs
(Contract N00014-75-C-0880)
(AD-A074182; TR-18-ONR) Avail: NTIS HC A02/MF A01 CSCL 11/6

The metal-metal bonded complexes (CO2(CO)6L2) (l = p(n-Bu)3, P(OPh)3) and Fe(n5-C5H5) (CO)2CO)(CO)3(P(OPh)3)) all undergo efficient (theta greater than 0.1 at 355 nm) photochemical metal-metal bond cleavage to produce reactive 17-valence electron (CO(CO)3L) fragments. In the presence of 1-pentene no alkene isomerization is found for L = P(n-Bu)3; low, but significant, photocatalytic activity is found for L = P(OPh)3 or when the P(n-Bu)3 complex is irradiated in the presence of P(OMe)3. The Co(CO)3L) precursors are strikingly more active when irradiation is carried out in the presence of HSiEt3, a hydride source. Both alkene isomerization and n-pentane formation are observed, along with small quantities of Si-containing products. The Fe(n to the fifth power-C5H5)(CO)2) radical photogenerated independently from (Fe2(n to the fifth power-C5H5)2(CO)4 is not active under any conditions used thus far. The activity of 17-valence electron radicals in this application is Co(CO)3(P (OPh)3)) = Co(CO)3(P(n-Bu)3)) = Fe(n to the fifth power-C5H5) (CO)2). These species are not themselves effective catalysts but do seem to react with HSiEt3 to form catalytically active, mononuclear Co-hydride complexes. GRA

N80-17204# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
US/AUSTRALIA COLLABORATIVE RESEARCH PROJECT

ON CORROSION FATIGUE IN D6AC STEEL JOINTS Final Report, Jan. 1974 - Aug. 1978
C. L. Harmsworth, D. S. Kemsley, and J. M. Finney Dec. 1978 112 p refs Prepared in cooperation with Aeronautical Research Labs., Melbourne
(AF Proj. 2418)
(AD-A076197; AFML-TR-78-150; ARL/Struc-370/MAT-108) Avail: NTIS HC A06/MF A01 CSCL 11/6

A U.S./Australian program has been conducted to determine the effect of manufacturing-induced and environmental corrosion on D6AC steel Taper-Lok bolted joints as used in the F-111 aircraft. Under constant amplitude, traces of distilled water or concentrated hydrochloric acid in the bolt holes did not reduce fatigue life. Under spectrum loading, traces of water did not affect fatigue life but traces of hydrochloric acid reduced the mean fatigue life of the joint by a factor of 110. The results of further constant amplitude tests and a limited series of spectrum tests confirmed previous findings that the life of those original joints in the F-111 which were manufactured using a six-flute hand reamer could be appreciably extended by rework with an 18-flute tapered reamer as used in later F-111 production. Other rework procedures involving cold working of the hole by a mandrel or specially designed fasteners showed little improvement when used in this relatively high-strength steel joint material. The effects of improved sealants and the capability of ultrasonic and magnetic NDI techniques for inspection of cracks at fastener holes were also investigated. It is concluded that the life of uncontaminated, properly fabricated and sealed D6AC steel joints as used in the F-111 wing carry through should not be a source of fatigue failure during a normal aircraft lifetime. GRA

N80-17205# Army Armament Research and Development Command, Dover, N. J. Fire Control and Small Caliber Weapon Systems Lab.
SINTERING CYCLE INFLUENCE ON P/M STEEL FORGINGS' DYNAMIC PROPERTIES Final Report
Andrew Crowson Aug. 1979 37 p refs
(DA Proj. 1T1-62105-AH-84)
(AD-A075244; AD-E400342; ARSCD-TR-79008) Avail: NTIS HC A03/MF A01 CSCL 11/6

The effects of sintering environments and their respective parameters on the dynamic properties of P/M steel forgings have been determined. Compacted preforms were sintered from 10 to 90 minutes over a range of temperatures (1100-1370 C) in inert, vacuum, and reducing atmospheres. The final oxide content was found to vary exponentially with sintering time, sintering temperature, and gas flow-rate regardless of the type of atmosphere used. Reduction of the metal oxides was basically controlled by two factors: (1) carbon, and (2) elevated temperature. Two levels of oxide reduction were evident. The initial level involved a reduction of the majority of the metal oxides (iron, molybdenum, and nickel oxides), whereas the secondary level resulted in a slow reduction of the more thermodynamically stable oxides of manganese and chromium. Elongation, reduction in area, and impact energy values showed a corresponding increase with decreasing oxide content. GRA

N80-17206# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
NEW SAMARIUM-2 COBALT-17-BASED COMPOUNDS FOR PERMANENT MAGNET APPLICATIONS
F. Rothwarf, H. A. Leupold, A. Tauber, J. T. Breslin, and R. L. Bergner Sep. 1979 15 p refs
(DA Proj. 1L1-61102-AH-47)
(AD-A075424; DELET-TR-79-20) Avail: NTIS HC A02/MF A01 CSCL 09/1

The magnetic properties of several samarium-2 cobalt-17-based alloy systems potentially useful for microwave/millimeter-wave applications are reviewed. Two types of materials are discussed. One contains heavy rare earth substituents for some samarium in an attempt to achieve intrinsically temperature stabilized magnets. The other contains manganese or chromium substituents for some cobalt in the samarium-2(cobalt, iron, copper, zirconium)-17 type compound in an effort to enhance the coercivity and to attain a more linear demagnetization curve for this material, which already has an energy product of 30 megagauss oersteds. GRA

N80-17207# Kentucky Univ., Lexington. Dept. of Metallurgical Engineering and Materials Science.
A STUDY OF THE ELECTROPLASTIC EFFECT IN METALS Final Technical Report, 1 Jan. 1977 - 31 May 1979
Hans Conrad and Kenji Okazaki 31 Jul. 1979 44 p refs
(Grant AF-AFOSR-3203-77; AF Proj. 2307)
(AD-A075267; AFOSR-79-0988TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

The effects of high density, direct current pulses (100 to 1000 A/sq. mm for periods of 55-120 microsecs) on the flow stress determined in an Instron tensile testing machine were studied in a number of polycrystalline metals representing various crystal structures (Pb, Sn, Fe and Ti), with most attention being focused on Ti. The current pulses produced a decrease in the flow stress delta (o sub p) in all four metals. The work on Ti indicated that delta (o sub p) contains a contribution in addition to heating and pinch effects. This contribution (the electroplastic effect) increased significantly with current density, interstitial content and temperature (77-300K), to a lesser degree with strain, but no change was detected for a 25 fold increase in strain rate. Computer calculations of the dynamic stress changes associated with the approximately sinusoidal current-time pulses employed here yielded a contribution due to the electron-dislocation interaction (for a current density of 5000 A/sq mm at 300K) which was 32% of delta (o sub p). A model is proposed for the electroplastic effect which is based on theoretical considerations that the current flow exerts a force on the dislocations which adds to the applied force pushing a dislocation against obstacles. Complementary studies were performed on: (a) the decremental unloading method for determining the internal stress in metals, (b) the effects of temperature, gain size and interstitial content on the flow stress of Ti and (c) plastic instability in Ti sheet. GRA

N80-17208# Illinois Univ. at Urbana-Champaign. Dept. of Metallurgy and Mining Engineering.
PHASE CHANGES IN THE NIOBIUM-HYDROGEN SYSTEM. 1: ACCOMMODATION EFFECTS DURING HYDRIDE PRECIPITATION
B. J. Makenas and H. K. Birnbaum 1 Jul. 1979 36 p refs
(Contract N00014-75-C-1012)
(AD-A075518) Avail: NTIS HC A03/MF A01 CSCL 11/6

The accommodation effects which accompany hydride precipitation were studied in the Nb-H system using T.E.M. Elastic accommodation and punching of prismatic dislocation loops in the solid solution matrix were observed on precipitation. The reversibility of the plastic accommodation processes was studied. Dislocation generation and motion in the hydride was observed during reversion. These observations were related to the volume changes due to hydride formation and to the thermodynamics of the phase change. Direct evidence for the inhibition of hydride precipitation due to trapping at O and N interstitials is presented. GRA

N80-17209# Hughes Research Labs., Malibu, Calif.
GaAs SURFACE PASSIVATION FOR DEVICE APPLICATIONS Interim Report, 15 Jun. - 15 Dec. 1978
C. L. Anderson, M. D. Clark, and J. W. Peters Wright-Patterson AFB, Ohio AFAL Mar. 1979 21 p
(Contract F33615-78-C-1444; AF Proj. 2305)
(AD-A075479; AFAL-TR-79-1057; IR-1) Avail: NTIS HC A02/MF A01 CSCL 11/6

This report describes the initial stages of a program to develop deposited dielectrics for GaAs device applications. Three applications of the dielectrics are being investigated: (1) isolation of control electrodes, (2) passivation of the GaAs surface, and (3) encapsulation of completed circuits. The dielectrics being studied include silicon oxynitride; mixtures of silicon nitrode and germanium nitride; and mixtures of silicon dioxide, gallium oxide, and aluminum oxide. Deposition techniques being employed are pyrolytic chemical vapor deposition, plasma-enhanced deposition, and photochemical deposition. This report describes the apparatus being used for this program and the chemical analysis of preliminary films deposited. No interface state measurements are reported. GRA

N80-17210# Rockwell International Corp., Anaheim, Calif. Electronics Research Center.

GaAs SURFACE EFFECTS Interim Report, 1 Jul. - 31 Dec. 1978
Gordon J. Kuhlmann Wright-Patterson AFB AFAL Jun. 1979 64 p refs
(Contract F33615-78-C-1591; AF Proj. 2305)
(AD-A075478; C78-851/501) Avail: NTIS HC A04/MF A01 CSCL 11/6

This report presents the results of the first six months of a program to investigate the passivation of GaAs surfaces using a native insulator. Ion implantation of phosphorus and subsequent oxidation of the surface was used to form the insulator. Post-implant annealing indicates that Chemical Vapor Deposition SiO2 has somewhat better encapsulating properties than sputtered Si3N4. It was found that high-dose phosphorus implantation significantly reduces decomposition of the semiconductor surface under the SiO2 encapsulant during high-temperature annealing. GRA

N80-17211# Argonne National Lab., Ill.
ION BOMBARDMENT-INDUCED CHANGES IN THE SURFACE COMPOSITION OF BINARY ALLOYS
N. Q. Lam, H. Wiedersich, and P. R. Okamoto 1979 8 p refs Presented at the Conf. on Irradiation Behavior of Metallic Mater. for Fast Reactor Core Components, Corsica, France, 5 Jun. 1979
(Contract W-31-109-eng-38)
(CONF-790657-5) Avail: NTIS HC A02/MF A01

Redistribution of alloy components during heavy-ion bombardment was investigated using a kinetic model that includes the effects of radiation-induced segregation and preferential sputtering. Theoretical predictions are qualitatively compared with recent experimental measurements. DOE

N80-17212# Argonne National Lab., Ill.
MARTENSITIC PHASE TRANSFORMATION IN SHAPE-MEMORY ALLOYS
A. A. Golestaneh 1979 15 p refs Presented at the Intern. Conf. on Martensitic Transformation, Boston, 24 Jun. 1979
(Contract W-31-109-eng-38)
(CONF-7906103-3) Avail: NTIS HC A02/MF A01

Isothermal studies are described of the shape-recovery phenomenon, stress-strain behavior, electrical resistivity and thermoelectric power associated with the martensite-parent phase reaction in the Ni-Ti shape-memory alloys. The energy-balance equation that links the reaction kinetics with the strain energy change during the cooling-deforming and heating cycle is analyzed. The strain range in which the Clausius-Clapeyron equation satisfactorily describes this reaction is determined. A large change in the Young's modulus of the specimen is found to be associated with the M yields P reaction. A hysteresis loop in the resistivity-temperature plot is found and related to the anomaly in the athermal resistivity changes during cyclic M yields P yields M transformation. An explanation for the resistivity anomaly is offered. The M structure is found to be electrically negative relative to the P structure. A thermal emf of > or = 0.12 mV is found at the M-P interface. DOE

N80-17213# Centre Technique des Industries Mecaniques, Senlis (France).
ON THE IMPROVEMENT OF CHROME PLATING IN A CIRCULATING ELECTROLYTE [AMELIORATION DES DEPOTS DE CHROME PAR DEPOSITION DANS UN ELECTROLYTE EN CIRCULATION]
F. Mortier and J.-J. Sabatier Feb. 1979 47 p refs In FRENCH
(CETIM-12-F-20-0) Avail: NTIS HC A03/MF A01

The literature concerning chrome electrodeposition is surveyed. Industrial electroplating processes and improvements in these processes are discussed. Problem areas in chrome electrodeposition including the toxicity of the baths, a relatively slow deposition rate often leading to hydrogen embrittlement, and the emission of poisonous gases during electroplating, are examined. Possible solutions to these problems including the use of chrome baths containing trivalent salts, the use of ultrasonics, exploiting the influence of forced electrolyte circulation, and varying the current of electrolysis, are studied. Special attention is paid to controlling the pH factor during the process. Author (ESA)

N80-17214# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium).
SCIENTIFIC AND TECHNICAL RESEARCH IN THE METAL WORKING INDUSTRY Annual Report [RAPPORT ANNUEL ON COMITE PERMANENT AU CONCEIL GENERAL]
6 Jun. 1979 40 p refs In FRENCH
Avail: NTIS HC A03/MF A01

The research and development efforts reported include foundry techniques, metal forming, machining and assembling metal parts, the development of metallurgy in electronics, and the use of automation and data processing in the metal working industry. Emphasis is placed on the growing role of electronics, especially microprocessors, in these applications. Author (ESA)

N80-17215# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ORDERING EFFECTS IN TRANSITION METAL ALLOYS IN RELATION TO THEIR ELECTRONIC STRUCTURES [EFFECTS D'ORDRE DANS LES ALLIAGES DE MATAUX DE TRANSITION EN RELATION AVEC LEUR STRUCTURE ELECTRONIQUE]
Guy Treglia 1978 74 p refs In FRENCH; ENGLISH summary
(ONERA-NT-1978-9) Avail: NTIS HC A04/MF A01

The ordering energy in transition metal alloys, contrary to the cohesive energy, can be written as the sum of effective pair interactions. These interactions are defined in terms of quantities calculated from the electronic structure of these metals. Two methods are used. First, for an annealed alloy, the susceptibility is calculated by means of a molecular field method using an extremization of the free energy. Then, the interactions by analogy with the Ising model are identified. The best thermodynamic one-site approximation is shown to be the coherent potential approximation (CPA). Using the second method for a 'frozen' alloy, the ordering energy is given by a generalized perturbation expression taking as a reference state the completely, disordered state treated within the usual CPA. Results show that both methods give the same concentration dependent effective pair interactions. This is true even if the charge transfers are taken into account. A detailed numerical discussion shows the validity range of this model to be the same as the CPA one. Author (ESA)

N80-17216# National Physical Lab., Teddington (England). Div. of Chemical Standards.
THE PHYSICOCHEMICAL PROPERTIES OF SLAGS. PART 4: SURVEY OF DATA ON INTERFACIAL PROPERTIES BETWEEN MOLTEN METALS AND MOLTEN SLAGS CONTAINING CaF2
B. J. Keene Jun. 1979 55 p refs
(NPL-Chem-99-Pt-4) Avail: NTIS HC A04/MF A01

Data from the literature on the interfacial properties between molten metals and molten slags contaning CaF2 were surveyed. Assessment of the data was not possible, since most of the studies have been conducted on complex systems, in which relatively small differences in surface-active components could have had a significant effect on the surface properties. Author (ESA)

N80-17217# National Physical Lab., Teddington (England). Div. of Chemical Standards.
THE PHYSIOCHEMICAL PROPERTIES OF SLAGS. PART 5: REVIEW OF THE PHASE DIAGRAMS FOR CaF2-BASED SLAGS
K. C. Mills Jul. 1979 89 p refs
(NPL-Chem-100-Pt-5) Avail: NTIS HC A05/MF A01

The extant information on phase diagrams for CaF2 based slags was collated and evaluated. The data for gaseous species given off by various molten slags were also reviewed as the reactions producing these species also affect the phase equilibria. Recommended phase diagrams for the various systems are reported. Author (ESA)

N80-17218# Centre Technique des Industries Mecaniques, Senlis (France).
THE INFLUENCE OF CEMENTATION CONDITIONS ON THE PRESSENCE OF RESIDUAL AUSTENITE AFTER TEMPERING. THE ROLE OF AUSTENITE IN CHARACTERIZING

THE IN-SERVICE MECHANICAL PROPERTIES OF PARTS Final Report [INFLUENCE DES CONDITIONS DE CEMENTATION SUR LA PRESENCE D'AUSTENITE RESIDUELLE APRES TREMPE. ROLE DE CETTE AUSTENITE SUR LE COMPORTEMENT EN SERVICE DES PIECES MECHANIQUES]
C. Tournier, A. Brucelle, and F. Lecroiscey 17 Apr. 1979 208 p refs In FRENCH
(CETIM-12-G-08-0) Avail: NTIS HC A10/MF A01

The relation between steels and the resulting structure during cementation were studied. Measurements by X-ray analysis and layer characterization show that the quantity of residual austenite in the cemented layers can be accurately predicted. Micrographic analysis which shows that the profile of other constituents (martenite, bainite, perlite) is closely linked to the level of austenite present, is discussed. The surface mechanical (fatigue) properties of the materials were studied. It was shown that when the level of austenite falls below 30 percent it is difficult to predict fatigue behavior. Author (ESA)

N80-17219# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Sect. Construction Metallique.
RESIDUAL DUCTIVITY IN WELDED JOINTS [RESERVE DE DUCTILITE DANS LES JOINTS SOUDES]
R. Baus (Belgium Univ., Liege), W. Chapeau (Belgium Univ., Liege), and M. Piron (Belgium Univ., Liege) Mar. 1979 71 p refs In FRENCH
(CRIF-MT-139) Avail: NTIS HC A04/MF A01

The measurement of residual ductility and its interpretation for welded joints in a wide range of steels is discussed. Results permit the quantitative evaluation of fracture risk for a welded joint undergoing tensile stress and containing a fault of a given dimension. Variables taken into consideration include the types of base and feeder metals used, type of heat treatment, mechanical characterisitcs, and the welding technique employed. Arc welding with laboratory control of the amount of hydrogen diffused into the weld is emphasized. The method of interpretation is based on methods used for notch tests on full scale specimens and involves a finite element analysis through a computer program. Author (ESA)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-17220*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LUBRICATION AND WEAR MECHANISMS OF POLYIMIDE-BONDED GRAPHITE FLUORIDE FILMS SUBJECTED TO LOW CONTACT STRESS
Robert L. Fusaro Jan. 1980 27 p refs
(NASA-TP-1584; E-9990) Avail: NTIS HC A03/MF A01 CSCL 11H

The tribological properties of polyimide-bonded graphite fluoride films were studied with a pin-on-disk friction apparatus. A 440 C HT stainless steel rider with a 0.95 millimeter diameter flat area was slid against the film in order to achieve a light, closely controlled contact stress. A 1 kilogram load was applied to this flat to give a projected contact stress of 14 megapascals. Two stages of lubrication were operating. In the first stage, the film supported the load and the lubricating mechanism appeared to be the shear of a thin surface layer of the film between the rider and the bulk of the film. The second stage began after the original film was worn away, and the lubricating mechanism appeared to be the shear of very thin lubricant layers between the flat area on the rider and flat plateaus generated on the sandblasted asperities of the metallic substrate. The major difference between the lubricating mechanisms of the hemispherical and flat riders was that the flat wore through the film much more slowly than did the hemisphere. K.L.

N80-17221*# Aerotherm Acurex Corp., Mountain View, Calif. Aerospace Systems Div.
SYNTHESIS OF IMPROVED PHENOLIC RESINS Final Report
C. B. Delano and A. H. McLeod 4 Sep. 1979 115 p refs
(Contract NAS3-21368)
(NASA-CR-159724; FR-79-25/AS) Avail: NTIS HC A06/MF A01 CSCL 11G

Twenty seven addition cured phenolic resin compositions were prepared and tested for their ability to give char residues comparable to state-of-the-art phenolic resins. Cyanate, epoxy, allyl, acrylate, methacrylate and ethynyl derivatized phenolic oligomers were investigated. The novolac-cyanate and propargyl-novolac resins provided anaerobic char yields at 800 C of 58 percent. A 59 percent char yield was obtained from modified epoxy novolacs. A phosphonitrilic derivative was found to be effective as an additive for increasing char yields. The novolac-cyanate, epoxy-novolac and methacrylate-epoxy-novolac systems were investigated as composite matrices with Thornel 300 graphite fiber. All three resins showed good potential as composite matrices. The free radical cured methacrylate-epoxy-novolac graphite composite provided short beam shear strengths at room temperature of 93.3 MPa (13.5 ksi). The novolac-cyanate graphite composite produced a short beam shear strength of 74 MPa (10.7 ksi) and flexural strength of 1302 MPa (189 ksi) at 177 C. Air heat aging of the novolac-cyanate and epoxy novolac based composites for 12 weeks at 204 C showed good property retention. Author

N80-17222# Army Construction Engineering Research Lab., Champaign, Ill.
INVESTIGATION OF RAPIDLY DEPLOYABLE PLASTIC FOAM SYSTEMS. VOLUME 1: SYSTEM DEVELOPMENT Final Report
Alvin Smith Oct. 1979 41 p refs 2 Vol.
(MIPR-FY1456-78-00006; MIPR-FY1456-79-00002)
(AD-A076332; CERL-TR-M-272-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 11/9

Volume 1 of this report (1) presents the findings of a study conducted to develop a low-density polyurethane foam system that is deployable within 5 seconds; and (2) documents a study of foam/fabric deployable shapes. An especially fast-reacting foam formulation was devised, hardware for delivery and mixing of foam chemicals was designed and evaluated, various geometric shapes of constant volume that the foam could be formed into were investigated, and the impact loading characteristics of the foam at various times soon after generation were studied. Fabrication of fabric foam cylinders was also studied. Volume 2 documents a study of fabric-skinned, foam-filled cylindrical beams and an analytical/experimental study of their bending properties. Results of the studies show that a low-density polyurethane foam system that will deploy within 5 seconds is practical to generate and to form into geometrically shaped lightweight fabric bags. The foam exhibits good impact absorption properties very quickly after formation; these properties can be used to attenuate rapidly applied loads of low to intermediate velocities. Finally, the fabric/foam composite beams possess interesting structural qualities commensurate with the fabric and foam used in making them. The analytical and experimental results compare very well. The analysis identified several factors of the mechanics involved that must be included in calculations to predict the loading response of such composites. GRA

N80-17223# Army Construction Engineering Research Lab., Champaign, Ill.
INVESTIGATION OF RAPIDLY DEPLOYABLE PLASTIC FOAM SYSTEMS. VOLUME 2: NONLINEAR DEFORMATION AND LOCAL BUCKLING OF KEVLAR FABRIC/POLYURETHANE FOAM COMPOSITES Final Report
Alvin Smith, S. S. Wang, and A. Y. Kuo Oct. 1979 49 p refs 2 Vol.
(MIPR-FY1456-78-00006; MIPR-FY1456-79-00002)
(AD-A076310; CERL-TR-M-272-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 11/9

The binding properties of fabric skiqned, foam filled cylindrical beams were investigated. Results show that a low density polyurethane foam system that will deploy within 5 seconds is practical to generate and to form good impact absorption properties very quickly after formation. These properties are used to attenuate rapidly applied loads of low to intermediate velocities. R.C.T.

N80-17224# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
MICROENCAPSULATED FLUORESCENT DYE PENETRANT Final Report, Oct. 1977 - Jan. 1979
S. Allinikov Jul. 1979 35 p ref
(AF Proj. 2421)
(AD-A076183; AFML-TR-79-4027) Avail: NTIS HC A03/MF A01 CSCL 11/3

Microencapsulated fluorescent dye penetrant materials were evaluated for feasibility as a technique to detect cracks on metal surfaces when applied as a free flowing dry powder. Various fluorescent dye solutions in addition to a commercial penetrant (Zyglo ZL-30) were microencapsulated and tested on nondestructive inspection crack standards. The material could be applied dry with standard spray apparatus, and removed by blowing air, vacuum or with a detergent water mixture. Indications of cracks 0.5 microns in width or larger could be visually observed in the tests conducted to date. GRA

N80-17225# Army Materials and Mechanics Research Center, Watertown, Mass.
CORROSION/EROSION BEHAVIOR OF SILICON NITRIDE AND SILICON CARBIDE CERAMICS: GAS TURBINE EXPERIENCE Final Report
R. Nathan Katz Apr. 1979 26 p refs Presented at the 23d Natl. SAMPE Symp., Anaheim, Calif., 3 May 1978
(ARPA Order 1849)
(AD-A076382; AMMRC-MS-79-2) Avail: NTIS HC A03/MF A01 CSCL 11/2

Ceramic materials, silicon nitride and silicon carbide in particular, are under intensive engineering development for gas turbine applications. One of the factors which has encouraged this line of development is the excellent corrosion/erosion behavior of these ceramics. This paper will briefly review some of the fundamental mechanisms and critical materials properties thought to govern the corrosion/erosion behavior of ceramics and point out where these differ from those of metals. A review of available erosion, corrosion, and combined corrosion/erosion testing of silicon nitrides and silicon carbides will be presented. While the results of these tests are quite encouraging, it is evident that there is a lack of data at high temperatures, in atmospheres containing multiple contaminates, and there is virtually no long-duration testing information. The author will suggest areas of research required to further our understanding of corrosion/erosion behavior and phenomena, and provide a more extensive data base for future engineering applications. GRA

N80-17226# Rockwell International Science Center, Thousand Oaks, Calif.
MICROSTRUCTURALLY DEVELOPED TOUGHENING MECHANISMS IN CERAMICS. STRESS-INDUCED PHASE TRANSFORMATIONS: THEORY OF PHASE RETENTION AND FRACTURE TOUGHNESS
F. F. Lange Oct. 1979 28 p refs
(Contract N00014-77-C-0441)
(AD-A076532; SC5117.6TR; TR-6) Avail: NTIS HC A03/MF A01 CSCL 11/2

The thermodynamics of a constrained transformation has been examined with regard to the conditions for phase retention during fabrication and the effect of a stress-induced transformation on the fracture toughness. Constraint of the shape change associated with the transformation by an elastic matrix will lower the transformation temperature. Retention also requires that a critical grain size (or particle size) cannot be exceeded during fabrication. Two binding solutions for the critical stress intensity factor (Kc) were obtained: one for the case where the transformation suffers no stress hysteresis effect and the other for a large stress hysteresis effect. Both indicate that Kc will depend on the transformation's shape change, the elastic properties of the constraining matrix, the volume fraction of the retained, metastable phase and temperature. Kc is predicted to decrease with increasing temperature. GRA

N80-17227# Monsanto Research Corp., Dayton, Ohio.
ASSESSMENT OF THE FLAMMABILITY OF AIRCRAFT HYDRAULIC FLUIDS Final Report, 15 Dec. 1975 - 30 Sep. 1978
Leo Parts Wright-Patterson AFB, Ohio AFAPL Jul. 1979 85 p refs
(Contract F33615-76-C-2015; AF Proj. 3048)
(AD-A076512; MRC-DA-860; AFAPL-TR-79-2055) Avail: NTIS HC A05/MF A01 CSCL 11/8

The main thrust of the program was directed toward two objectives: (1) development of apparatus for the measurement of ignitability characteristics of fluids at high temperatures (up to 930 C); and (2) the use of that and other apparatus for the determination of ignitability, flame propagation properties, and heats of combustion of a number of aircraft fluids. These included currently used hydraulic fluids, candidate nonflammable hydraulic fluids, and other aircraft fluids such as lubricants, fuels, and heat transfer fluids. The studies were successful in the identification of candidate nonflammable hydraulic fluids. These fluids were identified as Halocarbon AO-8, Freon E6.5, and Brayco 814Z. A semiautomatic ignition test apparatus was built that can be used for measurements at temperatures up to 1000 C. The operation range of a hot manifold ignition test apparatus was extended up to 930 C. GRA

N80-17228# Honeywell Corporate Material Sciences Center, Bloomington, Minn.
EFFECT OF WORKPIECE PROPERTIES ON GRINDING FORCES IN POLYCRYSTALLINE CERAMICS
B. G. Koepke and R. J. Stokes Jun. 1979 41 p refs
(Contract N00014-69-C-0123)
(AD-A075388; HONEYWELL-47502; TR-7) Avail: NTIS HC A03/MF A01 CSCL 20/2

Grinding forces have been measured on a number of polycrystalline ceramics and correlations between the forces and workpiece properties have been attempted in an effort to gain insight into mechanisms of chip formation. The closest correlations were with a parameter related to the indentation fracture characteristics of each workpiece. This suggests that a major mechanism of chip formation during multipoint abrasive machining of ceramics is fracture resulting from the plastic indentation of the workpiece by the abrasive grains. Grinding forces during up and down grinding were different but both correlated with the indentation fracture parameter when the comminution characteristics of the chips during down grinding were accounted for. GRA

N80-17229# Office of Naval Research, London (England).
HOW PLASTICS FAIL: THE CHURCHILL CONFERENCE
Willard D. Bascom Aug. 1979 16 p Presented at the 5th Intern. Conf. on Deformation, Yield and Fracture of Polymers, Cambridge, England, 2-5 Apr. 1979
(AD-A075433; ONRL-C-4-79) Avail: NTIS HC A02/MF A01 CSCL 11/9

This report reviews the presentations and discussion at the 5th International Conference on Deformation, Yield and Fracture of Polymers held at the University of Cambridge on 2-5 April, 1979. The work presented at the Conference gives some insight into the state-of-the-art of research on how polymeric materials fail. No breakthroughs were revealed, but the tone of the Conference suggested a coming to grips with nonlinear processes. GRA

N80-17230# Naval Surface Weapons Center, White Oak, Md.
MOISTURE SORPTION AND DIFFUSION IN HERCULES 3501-6 EPOXY RESIN Progress Report, Oct. 1977 - Oct. 1978
Joseph M. Augl 30 Mar. 1979 42 p refs
(AD-A076008; NSWC/TR-79-39) Avail: NTIS HC A03/MF A01 CSCL 11/9

The objective of this work was to obtain the moisture sorption equilibria of Hercules 3501-6 epoxy resin and its concentration dependent moisture diffusion coefficient. These data are necessary for predicting changes in aircraft structural composites properties where this resin is used as a matrix material. The data were obtained by sorption measurements with a Cahn electrobalance. It was found that the diffusion coefficient is strongly concentration-dependent at low moisture concentration, however, it is fairly flat at moisture concentrations corresponding to equilibrium concentration between 30 to 80 percent relative humidity. GRA

N80-17231# Akron Univ., Ohio. Inst. of Polymer Science.
BONDING ELASTOMER LAYERS TOGETHER BY A SURFACE OXIDATION REACTION
R. J. Chang, A. N. Gent, C. C. Hsu, and K. C. Sehgal Oct. 1979 34 p refs
(Contract N00014-76-C-0408)
(AD-A076265; TR-5) Avail: NTIS HC A03/MF A01 CSCL 07/3

An experimental study has been carried out of the self-adhesion of thin layers of three crosslinked elastomers: cis-polyisoprene (natural rubber) and two polybutadienes. For the polybutadiene materials, the strength of self-adhesion was found to be strongly dependent upon the time of exposure of the two surfaces to air before they were brought into contact. The strength rose dramatically during the first hour or so of exposure so that in some instances the layers could not later be forcibly separated. When the surfaces were exposed to air for longer periods before joining them, the strength of self-adhesion, caused by prior exposure to air for short periods, did not take place on exposure to nitrogen or for samples of cis-polyisoprene, and it was reduced or delayed in samples containing antioxidant. It is therefore attributed to surface oxidation reactions that can lead to the formation of interfacial covalent bonds with polybutadiene but not with polyisoprene. Some possible reaction schemes are discussed. GRA

N80-17232# State Univ. of New York at Stony Brook. Dept. of Chemistry.
POLYMER CONFORMATION BY LIGHT SCATTERING Final Report, 1 Sep. 1968 - 31 May 1979
Benjamin Chu Sep. 1979 6 p refs
(Grants DA-ARO(D)-31-124-73-G30;
DA-ARO(D)-31-124-70-G19; DAAG29-76-G-0005;
DAAG29-76-G-1030)
(AD-A076296; ARO-8014.30-C; ARO-13245.13-C) Avail: NTIS HC A02/MF A01 CSCL 07/4

In this project, we tried to study the conformation and dynamics of supramolecular solutions by developing the technique of laser light scattering and by examining the fluid behavior near the critical mixing point. We improved the technique of photon correlation spectroscopy and the method of data analysis so that we succeeded in establishing a new technique for measuring particle size distributions. By relating the tricritical point of fluid mixtures to the theta point in polymer solutions, we could now study polymer solution behavior in the semidilute and gel regions. GRA

N80-17233# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
INVESTIGATION OF A DEPLOYABLE POLYURETHANE FOAM GROUND IMPACT ATTENUATION SYSTEM FOR AEROSPACE VEHICLES. VOLUME 2: FIAS TEST NUMBERS 49 THROUGH 91 Final Report, Nov. 1976 - May 1978
Stephen R. Mehaffie Jul. 1979 229 p refs
(AF Proj. 1964)
(AD-A075658; AFFDL-TR-78-145-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 22/2

An investigation was conducted to determine the feasibility of an advanced deployable impact attenuation system for use with aerospace vehicles. Performance of the system with a boilerplate AQM-34V RPV was quantified through a series of full-scale impact tests. A prototype design and costing analysis is presented. The conclusion was that the Foam Impact Attenuation System (FIAS) could provide the optimum system for the ground recovery of RPV's. GRA

N80-17234# Argonne National Lab., Ill.
NONDESTRUCTIVE EVALUATION TECHNIQUES FOR HIGH-TEMPERATURE CERAMIC COMPONENTS Quarterly Report, Apr. - Jun. 1979
Jul. 1979 25 p refs
(Contract W-31-109-eng-38)
(ANL/MSD-79-5; QR-7) Avail: NTIS HC A02/MF A01

Silicon carbide samples with various microstructures were examined by through-transmission acoustic microscopy. The microstructures were ranked with respect to ease of inspection. Some preliminary results were presented on the use of a transducer and acoustic mirror for bore-side ultrasonic inspections of SiC heat exchanger tubing. The technique of photoacoustic microscopy is discussed. A simple test was run to illustrate the principles involved in this technique. DOE

N80-17235# Toulouse Univ. (France).
SELF EXTINCTION OF PARTIAL DISCHARGES IN INSULATING POLYMERIC MATERIALS INDUCED BY METALLIC CHELATES
Bui Ai, C. Huraux, and O. Issa 1978 6 p refs Sponsored by Delegation Gen. a la Rech. Sci. et Tech.
(Publ-350) Avail: NTIS HC A02/MF A01

Measuring apparatus for determining threshold voltage of partial discharge apparition in samples during their aging under alternative voltage is described. This apparatus made it possible to compare different types of additives as healing agents for insulator defects. Author (ESA)

N80-17236# Toulouse Univ. (France). Lab. de Genie Electrique.
HIGH FREQUENCY DIELECTRIC LOSSES IN POLYETHYLENE UNDER VERY HIGH HYDROSTATIC PRESSURE [LES PERTES DIELECTRIQUES EN HAUTE FREQUENCE DU POLYETHYLENE SOUMIS A DE TRES FORTES PRESSIONS HYDROSTATIONES]
Bui Ai, Hoang The Giam, D. Lebarbier, and S. C. Bapt 1978 5 p refs In FRENCH
(Publ-352) Avail: NTIS HC A02/MF A01

In order to study the effect of hydrostatic pressure on the insulating quality of polyethylene used in submarine telephone cables, laboratory experiments were carried out. The apparatus, including a high pressure chamber (1500 bar maximum working pressure), a General Radio 1690 A signal generator, and a Hewlet-Packard 4342 Q-meter, is described. Results indicate that the experimental setup can measure fine dielectric losses over a wide frequency range (0.1 to 15 MHz) and in a temperature range of from -10 C to 50 C. Author (ESA)

N80-17237# Toulouse Univ. (France). Lab. de Genie Electrique.
THIN POLYMER FILMS SYNTHESIZED BY LOW FREQUENCY GLOW DISCHARGE WITH APPLICATIONS TO ELECTRONICS AND MICROELECTRONICS [COUCHES MINCES DE POLYMERES OBTENUES PAR DECHARGE LUMINESCENTE ET LEURS APPLICATIONS EN ELECTRONIQUE ET MICROELECTRONIQUE]
Bui Ai, Y. Segui, D. Brosset, and M. Valentin 1978 20 p refs In FRENCH Presented at Journees d'Etudes sur les Plastiques dans l'Electron. et la Microelectron., Paris, 23-26 Apr. 1978
(Publ-353) Avail: NTIS HC A02/MF A01

The manufacturing procedure for polymer thin films and its application to thin film condensors and to semiconductor passivation are described. The experimental device consists of two aluminum electrodes creating a uniform electrostatic field in a chamber subjected to high vacuum. The glow discharge acts upon a continuous gaseous stream of styrene monomer. The influence of several parameters of the polymer film characteristics is discussed. An experimental capacitor of 160 sq mm is described, consisting of 160 five layers of succesive polymer and aluminum films on a glass substrate. Limiting the number of free radicals formed during the polymerization process allowed for the reduction of high frequency losses by a factor of five. The reported results for passivation application are also very promising. Author (ESA)

N80-17238*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
FACTORS AFFECTING THE FRACTURE ENERGY OF A STRUCTURAL ADHESIVE Interim Report
D. G. OConnor and H. F. Brinson Sep. 1979 104 p refs
(Grant NGR-47-004-090)
(NASA-CR-162475; PB-300473/6; VPI-E-79-31) Avail: NTIS HC A06/MF A01 CSCL 11A

Various adhesive fracture strength and energy tests and the mechanisms of mechanical and chemical adhesion are discussed. The sensitivity of the strain energy release rate to specimen preparation is considered. The rate and time dependence of the adhesive are then investigated using the TDCB specimen. The fractured surfaces are also studied using scanning electron microscopy to determine the mechanisms of failure. GRA

N80-17239# National Technical Information Service, Springfield, Va.

THE SYNTHESIS AND PROPERTIES OF POLYURETHANE RESINS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1973 - Oct. 1979

Diane M. Cavagnaro Nov. 1979 299 p Supersedes NTIS/PS-78/1092; NTIS/PS-77/0981; NTIS/PS-76/0922; NTIS/PS-75/745
(PB80-800477; NTIS/PS-78/1092; NTIS/PS-77/0981; NTIS/PS-76/0922; NTIS/PS-75/745) Avail: NTIS HC $30.00/MF $30.00 CSCL 11I

Topics covered include the synthesis, polymeriztion, casting, chemical properties, physical properties, and mechanical properties of urethane resins used in such applications as adhesives, solid propellants, coatings, biomaterials, structural members, and sealers. This updated bibliography contains 293 abstracts, 29 of which are new entries to the previous edition. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-17240 California Univ., Berkeley.

A STUDY OF VAPOR EXPLOSION PHENOMENA Ph.D. Thesis

Chih-Ping Tso 1979 145 p
Avail: Univ. Microfilms Order No. 8000550

A multi-mechanism physical model is proposed to explain vapor explosion. In particular, the model predicts the existence of an upper limit for the colder liquid above which no interaction is expected, regardless of the hot liquid temperature. Based on the model, interaction zones are presented for the tin-water, lead-water, aluminum-water, gallium-water, copper-water, uranium dioxide-water, uranium dioxide-sodium, and the glass-water systems. An experimental investigation was conducted whereby interaction zones were found for three small scale systems by melting 3 to 10 gm of pure metal in a crucible and dropping the metal into a water tank. The data for these three systems agree well with the proposed model. Dissert. Abstr.

N80-17241# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.

A COUPLED INTERIOR BALLISTICS FINITE ELEMENT COMBUSTION INSTABILITY ANALYSIS PROCEDURE, PART 2

Robert M. Hackett 26 Jun. 1979 40 p
(AD-A075110; DRDMI-T-79-68-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 19/4

A computer code is formulated which provides the solid propellant grain designer with the capability of performing an interior ballistics analysis while, with a minimum amount of additional effort, at the same time performing a combustion instability prediction analysis at any designated point in time during the entire period of performance. The program, in effect, couples the output of an existing solid propellant grain design evaluation code, which predicts the acoustic chamber geometry during surface regression, with the input to the existing three-dimensional finite element combustion instability prediction code, FLAP3. The three-dimensional finite element mesh and boundary conditions are generated from the grain surface regression data for the progressive burn times. The entire finite element mesh and boundary condition generation by FLESH3, the companion to FLAP3, is executed with the input of seven geometry parameters, which are obtained from the ballistics code output, and the corresponding burn depth parameter. The use of the developed program is demonstrated for three different values of burn depth for the case of a typical star design. GRA

N80-17242# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

THERMAL OXIDATIVE STABILITY TEST METHODS FOR JPTS JET FUEL Final Report, Jan. 1976 - Dec. 1978

Royce P. Bradley and Charles R. Martel Aug. 1979 53 p refs
(AF Proj. 3048)
(AD-A076374; AFAPL-TR-79-2079) Avail: NTIS HC A04/MF A01 CSCL 21/4

Various samples of Thermally Stable Jet Fuel (JPTS) produced in accordance with military specification MIL-T-25524, were tested for thermal oxidative stability using the Jet Fuel Thermal Oxidation Tester (JFTOT). Two of the fuel samples had marginal thermal stability and provided data needed for the proposed substitution of the JFTOT for the ASTM-CRC Fuel Coker. Over 130 samples of JPTS fuel, submitted for fuel specification compliance test, were tested for thermal oxidative stability using the JFTOT in lieu of the Fuel Coker. The JFTOT, in conjunction with the Alcor Mark 8A Tube Deposit rater, was found to be suitable for the use with JPTS fuels. GRA

N80-17243# Sandia Labs., Albuquerque, N. Mex. Process Research Div.

APPLICATION OF RADIOGRAPHY TO COAL LIQUEFACTION

D. G. Sample and M. G. Thomas 1979 16 p refs Presented at the ASNT Fall Conf., St. Louis
(Contract EY-76-C-04-0789)
(SAND-79-1226C; CONF-791008-2) Avail: NTIS HC A02/MF A01

The application of X-radiographic techniques to the investigation of coal and coal liquefaction systems is discussed. The analysis of catalysts used in coal liquefaction by wavelength and energy dispersive analyses, identification and isolation of tagged catalysts using film radiography, and measuring mineral matter in coal with a radiation gage are among the topics covered. DOE

N80-17244# Los Alamos Scientific Lab., N. Mex.

PRODUCTION OF SYNTHETIC GAS FROM NUCLEAR ENERGY SOURCES

C. A. Anderson, J. C. Biery, and L. A. Booth Apr. 1979 235 p refs
(Contract EW-78-Y-04-4183)
(LA-7592-MS) Avail: NTIS HC A11/MF A01

A survey of nuclear energy sources and their potential application to the production of synthetic gas is documented. The state-of-the-art in commercial nuclear fission reactors and on-going research and development in advanced reactors is described. The status of fusion energy research and estimated timing of commercial availability are reported. Surveys of high temperature electrolysis and thermochemical cycles as means for producing synthetic gas from process heat are given. Synthetic gas production from radiolysis is discussed. A description of the nuclear fuel cycle and uranium reserve and resource estimates are presented. DOE

N80-17245# Research Inst. of National Defence, Linkoeping (Sweden).

BURNING TESTS FOR FUEL RICH HTPB (HYDROXYL TERMINATED POLYBUTADIENE) POWDER WITH AMMONIUM PERCHLORATE AS AN OXIDIZER [FOEBRAWNNINGSEGENSKAPER FOER BRAENSLERIKS HTPB-KRUT MED AMMONIUMPERKLORAT (AP) SOM OXIDATOR]

Torsten Liljegren and Bert Anderson Mar. 1979 22 p refs In SWEDISH
(FOA-C-20299-D1) Avail: NTIS HC A02/MF A01

Fuel rich, terminated polybutadien designed for a hybrid motor has been tested for combustion characteristics in a rocket engine. Using a combustion catalyst and finely divided perchlorate, the perchlorate content can be reduced 30% while maintaining combustion stability. Burning time of mixtures containing from 30% to 60% ammonium perchlorate are given. The effects of temperature on burn time is more pronounced in powders containing 40% ammonium perchlorate than on normal powders. Author (ESA)

N80-17246# Institut Francais du Petrole, Rueil-Malmaison. Lab Recherches Chemiques de Base.

STORING HYDROGEN IN THE FORM OF LIGHT ALLOY HYDRIDES Final Report [STOCKAGE DE L'HYDROGENE SOUS FORME D'HYDRURES D'ALLIAGES DE METAUZ LEGERS]
Edouard Freund and Christine Guillerm Jul. 1978 58 p refs In FRENCH
(IFP-26-209) Avail: NTIS HC A04/MF A01

Different hydrides are investigated to find a system with a sufficiently high storage density (> or = 3 percent). The formation of hydrides with light alloys is examined. Reaction kinetics for hydride formation were defined and applied to the systems Mg-Al-H, Mg-Al-Cu-H, Ti-Al-Hi, Ti-Al-Cu-H, and Ti-Al-Ni-H. Results indicate that the addition of Al destabilizes MgH2 and TiH2 hydrides while having only a limited effect on the storage density. Author (ESA)

N80-17101 Aerojet Solid Propulsion Co., Sacramento, Calif.
THE EFFECT OF PROPELLANT FORMULATION VARIABLES ON COMBUSTION STABILITY
G. A. Zimmerman and M. J. Ditore *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 83-99 refs (For primary document see N80-17097 08-12)
Avail: Issuing Activity

N80-17102 Thiokol Corp., Huntsville, Ala. Huntsville Div.
EFFECTS OF FORMULATION VARIABLES ON THE COMBUSTION STABILITY CHARACTERISTICS OF SOME REDUCED SMOKE PROPELLANT
R. B. Kruse and D. W. Booth *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 99-118 ref (For primary document see N80-17097 08-12)
Avail: Issuing Activity

N80-17103 Aerojet Solid Propulsion Co., Sacramento, Calif.
EQUILIBRIUM MODEL FOR SECONDARY SMOKE PREDICTION
James P. Coughlin *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 119-133 refs (For primary document see N80-17097 08-12)
Avail: Issuing Activity

N80-17104 Army Missile Research and Development Command, Redstone Arsenal, Ala.
COMPARISON OF FLUORINE AND CHLORINE CONTAINING COMPOUNDS ON SECONDARY SMOKE FORMATION
M. T. Cucksee and H. C. Allen *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 135-143 (For primary document see N80-17097 08-12)
Avail: Issuing Activity

N80-17118* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MATERIALS COMPATIBILITY WITH FLUORINE
L. R. Toth, J. C. Lewis, and C. M. Moran *In* APL The 1979 JANNAF Propulsion Meeting, Vol. 1 Mar. 1979 p 583-606 refs (For primary document see N80-17097 08-12)
(Contract NAS7-100)
Avail: Issuing Activity CSCL 21I

N80-17273 Southwest Research Inst., San Antonio, Tex.
PREDICTION OF CONSTRAINED SECONDARY FRAGMENT VELOCITIES
Peter S. Westine and John H. Kineke, Jr. (Ballistic Research Labs., Aberdeen, Md.) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 183-192 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-17247 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION BULLETIN. PART 1: KEYNOTE ADDRESS, INVITED PAPERS, PANEL SESSIONS, MODAL TEST AND ANALYSIS
Sep. 1978 149 p Symp. held at Huntsville, Ala., 18-20 Oct. 1977; sponsored by Army Missile Res. and Develop. Command 4 Vol.
(Bull-48-Pt-1) Avail: NRL, Tech. Inform. Div., Washington, D.C.

The theory and application of modal vibration testing is discussed. Topics include the distribution of shaker forces in multiple shaker modal testing, modal confidence factor in vibration testing, transfer function applications to spacecraft structural dynamics, the characterization of torpedo structural modes and resonant frequencies, and Laguerre function representation of transients. For individual titles, see N80-17248 through N80-17257.

N80-17248 Army Engineer Waterways Experiment Station, Vicksburg, Miss.
TECHNICAL INFORMATION RESOURCES FOR THE SHOCK AND VIBRATION COMMUNITY c82
Edward J. Kolb *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 11-18 (For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

An overall assessment of the growth and future of information storage techniques is presented. A review of the growth patterns for the communication industry, specifically the increasing use of computers is presented. The management and storage of shock and vibration information is examined through the above concepts. A.W.H.

N80-17249 Geological Survey, Washington, D. C.
EARTHQUAKES: THEIR CAUSES AND EFFECTS c46
Robert M. Hamilton *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 19-21 (For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

The causes of earthquakes and the topic of earthquake prediction are discussed. The ability to control earthquakes is reported through an experiment at the Rangely oil field in Colorado. A.W.H.

N80-17250 Martin Marietta Corp., Denver, Colo.
FORCE APPORTIONING FOR MODAL VIBRATION TESTING USING INCOMPLETE EXCITATION c39
G. Morosow and R. S. Ayre (Colorado Univ., Boulder) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 39-48 (For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

A technique is presented for determining the shaker forces necessary to isolate a mode during a modal vibration test. The method is based on the multiple exciter, tuned dwell approach. Several assumptions are made in the approach including: the modal is linear and, therefore, the superposition of modal responses holds; only proportional damping is considered; all shaker forces are phase coherent; and the approach is derived for a discrete system, and therefore, by inference the method is applicable to continuous systems. Two examples are presented to demonstrate the technique. A.W.H.

N80-17251 Virginia Polytechnic Inst. and State Univ., Blacksburg.
ON THE DISTRIBUTION OF SHAKER FORCES IN MULTIPLE-SHAKER MODAL TESTING c39
W. L. Hallauer, Jr. and J. F. Stafford *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 49-63 (For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

A method for structural dynamic modal testing by multiple shaker sinusoidal excitation is reviewed, and its theory and application are discussed. Numerical results from simulated modal testing on mathematical structural models are presented to illustrate the strengths and weaknesses of the method. The characteristics of these modals include damping which couples the normal modes and closely spaced modes. Numerical techniques required for implementation of the method are cescribed. A procedure is suggested for replacing actual mechanical tuning with calculations employing transfer function data. A.W.H.

N80-17252* Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
MODAL CONFIDENCE FACTOR IN VIBRATION TESTING c39
Sam R. Ibrahim *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 65-75 (For primary document see N80-17247 08-31)
(Grant NsG-1459)
Avail: NRL, Tech. Inform. Div., Washington, D.C. CSCL 20K

The theory and applications of a time domain modal test technique are presented. The method uses free decay of random responses from a structure under test to identify its modal characteristics namely, natural frequencies, damping factors, and mode shapes. The method can identify multimodal (highly coupled) systems and modes that have very small contribution in the responses. A method is presented to decrease the effects of high levels of noise in the data and thus improve the accuracy of identified parameters. This is accomplished using an oversized mathematical model. The concept of modal confidence factor (MCF) is developed. The MCF is a number calculated for every identified mode for a structure under test. The MCF varies from 0.000 for a distorted, nonlinear, or noise mode to 100.0 for a pure structural mode. The theory of the MCF is based on the correlation that exits between the modal deflection at a certain station and the modal deflection at the same station delayed in time. The theory and application of the MCF is illustrated by two experiments. The first experiment deals with simulated responses from a two degree of freedom system with 20 percent, 40 percent, and 100 percent noise added. The second experiment was run on a generalized payload model. The free decay response from the payload model contained about 22 percent noise. A.W.H.

N80-17253 Institut National des Sciences Appliquees de Lyon, Villeurbanne (France).
A BUILDING BLOCK APPROACH TO THE DYNAMIC BEHAVIOR OF COMPLEX STRUCTURES USING EXPERIMENTAL AND ANALYTICAL MODAL MODELING TECHNIQUES c39
J. C. Cromer, M. Lalanne, D. Bonnecase, and L. Gaudriot *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 77-91 refs (For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

An approach that takes into account constrained or unconstrained substructures is used to connect components whose properties are determined by experiments to those modeled by finite element techniques. Using a transfer function analyzer system, the constrained and unconstrained modal methods are applied to a beam in bending. The methods are then applied to a complex practical structure and agreement between experimental and theoretical results is shown to be good. K.L.

N80-17254 Hughes Aircraft Co., El Segundo, Calif.
TRANSFER FUNCTION APPLICATIONS TO SPACECRAFT STRUCTURAL DYNAMICS c18
J. R. Fowler and E. Dancy (Hewlett-Packard Co., Los Angeles) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 93-101 refs (For primary document see N80-17247 08-31)
(Contract IS-774)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

Fast Fourier transform computed transfer functions are used for several spacecraft applications. An Intelsat 4A spacecraft is tested using several excitations and the resulting transfer functions are compared using modal frequencies and damping. Examples are given of mass and stiffness computations from transfer functions and the use of alternative reference points for the transfer functions. The use of slight changes in transfer functions to detect failures is also demonstrated. K.L.

N80-17255 Martin Marietta Corp., Denver, Colo.
LOAD TRANSFORMATION DEVELOPMENT CONSISTENT WITH MODAL SYNTHESIS TECHNIQUES c39
R. F. Hruda and P. J. Jones *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 103-109 (For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

A method is presented for the development of component internal load transformations consistent with modal synthesis procedures. The resulting load transformations account for component interactions across statistically indeterminate interfaces. An economical method of obtaining these transformations is used along with a modified modal coupling procedure. K.L.

N80-17256 Westinghouse Research and Development Center, Pittsburgh, Pa.
REDUCED SYSTEM MODELS USING MODAL OSCILLATORS FOR SUBSYSTEMS (RATIONALLY NORMALIZED MODES) c39
F. H. Wolff and A. J. Molnar *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. Sep. 1978 p 111-118 refs (For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

A method of using modal oscillators to represent complex structural subcomponents is developed which can be applied to unidirectional models. It is shown that the oscillator mass must be the effective mass to guarantee the correct total system characteristics. When the modes are normalized in a specific way the effective mass and generalized or modal mass are identified. K.L.

N80-17257 Wright State Univ., Dayton, Ohio.
LAGUERRE FUNCTION REPRESENTATIONS OF TRANSIENTS c64
G. R. Spalding *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 137-141 refs (For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

The use of Laguerre functions in modeling the dynamic response of highly damped systems is discussed. Laguerre functions of varying time constant are generated from the Laguerre polynomials. By sampling at the axis crossings of the nth order Laguerre polynomial, system response can be represented by a finite set of orthonormal vectors. These vectors provide both a representation that is exact at the measurement points and interpolation functions that can be suited to the application. K.L.

N80-17258 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION BULLETIN. PART 2: ISOLATION AND DAMPING, IMPACT, BLAST
Sep. 1978 234 p refs Presented at the 48th Symp. on Shock and Vibration, Huntsville, Ala., 18-20 Oct. 1977; sponsored by Army Missile Res. and Develop. Command 4 Vol.
(Bull-48-Pt-2) Avail: NRL, Tech. Inform. Div., Washington D.C.

Damping materials tests and impact load tests highlight an analysis on vibration isolators and structural response to impact loads and blasts. Topics include bird impact loading, testing piping constraint energy absorbers for reactor containment applications, structural damping techniques for vibration control, and a determination of specifications for damping materials characteristics and performance. For individual titles, see N80-17259 through N80-17274.

N80-17259 Air Force Materials Lab., Wright-Patterson AFB, Ohio.
SPECIFICATION OF DAMPING MATERIAL PERFORMANCE c39
David I. G. Jones and J. P. Henderson *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 1-11 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

The development of a specification for controlling damping material performance is studied. An approach to the problem is discussed which involves (1) the establishment of an appropriate and adequate method for measuring the data needed, namely a particular form of the resonant beam technique, and (2) the specification of the required material properties in terms of a complex modulus reduced temperature nomogram with allowable limits superimposed. Details of the utilization of the resonant beam technique, particularly with a sandwich configuration, is presented for soft viscoelastic materials. Recommended specimen geometries and testing procedures are described. The use of the resonant beam test technique as a possible standard method for measuring complex dynamic moduli of damping materials is evaluated. A.W.H.

N80-17260 Air Force Materials Lab., Wright-Patterson AFB, Ohio.

A REDUCED-TEMPERATURE NOMOGRAM FOR CHARACTERIZATION OF DAMPING MATERIAL BEHAVIOR c39

David I. G. Jones *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 13-22 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

A reduced temperature nomogram was developed which simplifies the task of collapsing test data into the form of universal reduced frequency master curves. The master curves allow the materials properties to be read directly off the graph as a function of both frequency and temperature. The steps necessary, after a reduced frequency plot is drawn, to create a reduced temperature plot are described. The plot is achieved by superimposed oblique coordinates on the master curve to represent the temperature variations. Examples are provided illustrating the development and application of typical nomographs. A.W.H.

N80-17261 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

COMPUTERIZED PROCESSING AND EMPIRICAL REPRESENTATION OF VISCOELASTIC MATERIAL PROPERTY DATA AND PRELIMINARY CONSTRAINED LAYER DAMPING TREATMENT DESIGN c39

Lynn C. Rogers and Ahid D. Nashif (Anatrol Corp., Cincinnati, Ohio) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 23-37 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

Technology advancements in the state of the art of processing and representing modulus and loss factor data as a function of temperature and frequency are presented. The application of the characterized properties of materials to study the performance of various damping treatments is discussed. A method for performing preliminary constrained layer damping treatment design covering the complete range of practical engineering parameters is outlined. The curve fitted analytical expressions of the modulus and loss factor, used to predict the amount of damping achieved when a constrained layer treatment is applied to a vibrating structure, are discussed. The predicted results were compared with measured results over a wide temperature and frequency range. A.W.H.

N80-17262 Lord Kinematics, Erie, Pa.

NEW STRUCTURAL DAMPING TECHNIQUE FOR VIBRATION CONTROL c39

B. M. Patel, G. E. Warnaka, and D. J. Mead (Southampton Univ., England) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 39-52 (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

A structural damping configuration is presented which makes efficient use of damping materials by subjecting them to both shear and extensional deformations. The configuration consists, in one form, of a series of rows of vertically oriented platelets with damping material sandwiched between them. Adjacent rows of platelets may overlap each other to enhance the deformation of the damping material. A theoretical analysis of the configuration is reported and compared with experimental results for a variety of varying configurations. The structural damping configuration is shown to apply to very rigid structures where it can control flexural vibrations and sound radiation with low added weight. A mathematical model of the structural damping design optimization is described. A.W.H.

N80-17263 Air Force Materials Lab., Wright-Patterson AFB, Ohio.

VIBRATIONS OF A COMPRESSOR BLADE WITH SLIP AT THE ROOT c07

David I. G. Jones and Agnieszka Muszynska (Polish Academy of Sciences, Warsaw) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 53-61 (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington D.C.

An analytical model, developed to represent the vibrational behavior of a jet engine compressor blade in its fundamental mode, and which allows for slip at the blade disc interface, is described. The model is applied to a particular blade geometry and the results are compared. The implications of using the model for the design of compressor and turbine blades in order to optimize slip damping levels are discussed. A.W.H.

N80-17264 Army Engineer Waterways Experiment Station, Vicksburg, Miss.

RESPONSE OF A HELICAL SPRING CONSIDERING HYSTERETIC AND VISCOUS DAMPING c39

P. F. Mlakar and R. E. Walker *In* the Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 63-74 (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington DC.

An analytical model of a helical spring is developed which includes distributed mass, viscous damping, and hysteretic damping. The limiting effects of both types of damping on the resonant response are discussed. The model is compared with experimental data and it was found that viscous damping limits the resonant response of a helical spring. The effect of hysteretic damping is discussed and a correlation between the system loss factor due to combined viscous and hysteretic damping and the system loss factors for each type of damping alone is reported. A.W.H.

N80-17265 Sikorsky Aircraft, Stratford, Conn.

DAMPING OF AN ENGINE EXHAUST STACK c07

John J. DeFelice and Ahid D. Nashif (Anatrol Corp., Cincinnati, Ohio) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 75-84 (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington D.C.

A program whose objective was to introduce high damping into the helicopter engine exhaust extension in order to decrease its vibrational amplitude at resonance and thereby increase its fatigue life is described. A specialized high temperature damping material, in the form of vitreous enamel, reported to work effectively over the operational temperature range of the exhaust extension is examined. The application of the high temperature damping materials to the engine exhaust extension and the effect upon the vibrational amplitudes at resonance and component service life are discussed. A.W.H.

N80-17266 Arya Mehr Univ. of Technology, Teheran (Iran). Dept. of Mechanical Engineering.

MULTI-VARIABLE OPTIMIZATION FOR VIBRATION ISOLATION OF ROAD VEHICLES c37

Ebrahim Esmailzadeh *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 85-96 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington D.C.

The transmission of road-generated vibrations into a vehicle body is treated as a source-path-receiver problem. The suspension system acts as the path, and improved isolation can be achieved by having a single compliant bushing at the connecting point of the shock absorber to the body with none at the other end. A mathematical model is derived for such a system and an expression for the absolute displacement transmissibility of the body and that of the wheel is derived. An optimization procedure is applied in order to evalute the optimum values of the non-dimensional variables involved. This minimizes the maximum motion transmitted to the body from the road surface over a broad frequency range. Author

N80-17267* Lord Kinematics, Erie, Pa.

ISOLATION MOUNTS FOR THE HEAO-B X-RAY TELESCOPE c37

H. L. Hain and R. Miller (American Science and Engineering, Inc., Cambridge, Mass.) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 97-113 refs (For primary document see N80-17258 08-31)
(Contract NAS8-30750)
Avail: NRL, Tech. Inform. Div., Washington D.C. CSCL 13I

The orbiting HEAO-B X-ray telescope experiment package is described as well as the isolation mounts which will be used to support and protect it. The design and testing phases of the isolation development program are discussed and data are presented. A.R.H.

N80-17268 Air Force Materials Lab., Wright-Patterson AFB, Ohio.
BIRD IMPACT LOADING **c03**
J. S. Wilbeck and J. P. Barber (Dayton Univ. Research Inst., Ohio) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 115-122 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington D.C.

An extensive experimental program to investigate the mechanics of bird impact and to define the loads which birds exert at impact, is described. Bird impact pressures were measured by impacting birds against a heavy steel plate in which piezoelectric transducers were flush mounted. Data was collected for bird masses ranging from 60g to 4kg and velocities ranging from 50 to 300 m/s. Results are presented and compared with the predictions of a fluidynamic theory. A.R.H.

N80-17269 New Mexico State Univ., Las Cruces. Physical Science Lab.
FREQUENCY RESPONSE AND DIFFERENTIATION REQUIREMENTS FOR IMPACT MEASUREMENTS **c39**
Anthony S. Hu and Iian-Tau Chen *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 123-130 refs (For primary document see N80-17258 08-31) (Contract DOT-HS-6-01400)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

Impact response data are often subjected to integration and differentiation procedures. These procedures are low- and high-pass filtering processes. The measurement frequency response requirements are discussed using harmonic analysis and the requirements are related to three differentiation procedures. Results indicate that for operations in the frequency domain, the bandwidth used for differentiation must be higher than that used to reconstruct the function itself. For operations in the time domain, the sampling rate must be sufficiently high to avoid frequency cutoff. A.R.H.

N80-17270 SRI International Corp., Menlo Park, Calif.
STRUCTURAL RESPONSE OF EARTH PENETRATORS IN ANGLE-OF-ATTACK IMPACTS **c39**
J. D. Colton *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 131-141 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

An analysis based on a one-dimensional beam-mass model was developed to predict the early-time response of penetrator structures in angle-of-attack impacts. It was found that the peak compressive strain, which determines whether or not the penetrator casing fails, depends on the magnitude of the lateral load produced by impacts at an angle of attack, the load rise time (which is inversely proportional to impact velocity), and the relative mass of the nose and aft sections. By relating the loading to the impact conditions through empirical data, a procedure was devised to characterize the strength of penetrator structures in terms of impact velocity and angle of attack. The resulting critical impact curves can be used to make tradeoffs among structural dimensions (e.g., length and wall thickness), to select the best structure for a particular application, and to provide a framework for planning and interpreting experiments and more detailed calculations. Author

N80-17271 SRI International Corp., Menlo Park, Calif.
FINITE ELEMENT ANALYSIS OF MULTICOMPONENT STRUCTURES IN RIGID BARRIER IMPACTS **c09**
J. K. Gran, L. E. Schwer, J. D. Colton, and H. E. Lindberg *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 153-160 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

Techniques are presented for the transient analysis of multicomponent structures impacting rigid barriers using the finite element method. The analysis considers distortion and failure of joints, multiple impacts, and elastic-plastic material behavior. The models for each component of an example structure are developed separately, guided by the results of impact experiments. A comparison of the predictions of these finite element models with the results of the experiments demonstrates the applicability and accuracy of the models. The complete structure is then analyzed by combining the component models. The net result is good correlation of experiment and analytical prediction for the acceleration of a mass on a rather complex structure. Author

N80-17272 Franklin Inst. Research Labs., Philadelphia, Pa.
TESTING PIPING CONSTRAINT ENERGY ABSORBERS FOR REACTOR CONTAINMENT APPLICATIONS **c39**
R. C. Yaeger and R. C. Chou *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 161-181 ref (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

A drop testing machine was developed and used to provide experimental data for use in the application of a design concept for durable low cost energy absorbers to a real reactor installation. The instrumentation, data acquisition, and data processing systems are described and the test program is discussed, including some of the problems encountered and their solutions. Typical analog records are shown as well as digital plots of the same data. A.R.H.

N80-17273 Southwest Research Inst., San Antonio, Tex.
PREDICTION OF CONSTRAINED SECONDARY FRAGMENT VELOCITIES **c28**
Peter S. Westine and John H. Kineke, Jr. (Ballistic Research Labs., Aberdeen, Md.) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 183-192 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

The applied specific impulse solution from the detonation of line sources is obtained by performing a model analysis, and curve fitting the resulting pi terms to experimental test data. Forty-eight tests on a variety of spheres and cylinders with different orientations, various amounts of explosive, and numerous standoff distances were subjected to blast waves from line sources and had the impulse imparted to the object determined by measuring velocities. Fragment velocities for objects which had originally been constrained as cantilever or clamped-clamped beams were obtained by modifying the impulse-momentum relationship used in velocity predictions for unconstrained fragments. Use of approximate analtyical energy solutions for various modes of failure in brittle as well as ductile materials indicate that the impulse term could be reduced by the square root of a structural strain energy related to toughness (area under the true stress-strain curve) and fragment volume. Sixty observed velocities on 1020 steel, 1095 steel, and 2024-T3 aluminum beams of different sizes and with various applied specific impulses were used to complete this second solution and demonstrate its validity. A.R.H.

N80-17274 Agbabian Associates, El Segundo, Calif.
IMPEDANCE TECHNIQUES FOR SCALING AND FOR PREDICTING STRUCTURE RESPONSE TO AIR BLAST **c39**
F. B. Safford, R. E. Walker (Army Waterways Experiment Station, Vicksburg, Miss.), and T. E. Kennedy (Defense Nuclear Agency, Washington, D.C.) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 193-214 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington D.C.

Transfer impedances were measured on a 1/12-scale model and on its prototype structure. The structure was the Periometer Acquistion Radar Building (PARB) of the SAFEGUARD ABM System, which mesures 125 ft (38 m) in height, 194 ft (59 m) on its front, and 210 ft (64 m) on its side, with exterior walls 2 to 6 ft (0.9 to 1.8 m) thick. The impedance measurements for both structures were then used with air-blast loads to predict internal acceleration responses. Predictions for the model were compared to test acceleration records taken when the model was excited by an air blast generated from a 500-ton (453,550 kg) TNT explosion. The data were scaled for comparison with prototype responses. Author

N80-17275 Shock and Vibration Information Center (Defense), Washington, D. C.

THE SHOCK AND VIBRATION BULLETIN. PART 3: STRUCTURAL ANALYSIS, FATIGUE

Sep. 1978 118 p refs Presented at the 48th Symp. on Shock and Vibration, Huntsville, Ala., 18-20 Oct. 1977; sponsored by Army Missile Res. and Develop. Command

(Bull-48-Pt-3) Avail: NRL, Tech. Inform. Div., Washington, D.C.

Structural analysis techniques applicable to the evaluation of vibration and its effects are discussed. Fatigue damage under the conditions of random vibration is also considered. For individual titles, see N80-17276 through N80-17288.

N80-17276 Washington Univ., St. Louis, Mo. Dept. of Civil Engineering.

A SOURCE OF LARGE ERRORS IN CALCULATING SYSTEM FREQUENCIES **c39**

Robert M. Mains *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 1-4 (For primary document see N80-17275 08-31)

Avail: NRL, Tech. Inform. Div., Washington, D.C.

Errors in system frequency calculations resulting from the use of nondiagonal mass matrices with eigenvalue routines that replace the mass matrix with its eigenvalues before proceeding to the calculation of system frequencies are discussed. The errors are illustrated in several solutions of an 18 degree of freedom system. Ways to avoid these errors are considered. J.M.S.

N80-17277 Paris Univ. (France). Lab. de Mecanique Appliquee.

RESEARCH METHOD OF THE EIGENMODES AND GENERALIZED ELEMENTS OF A LINEAR MECHANICAL STRUCTURE **c39**

R. Fillod and J. Diranda *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 5-12 refs (For primary document see N80-17275 08-31)

Avail: NRL, Tech. Inform. Div., Washington, D.C.

A method which determined the eigenfrequencies, eigenmodes and generalized elements of a structure is described. Of all the methods tested, those based on the appropriation of modes seem to give the most accurate results. The method presented is based on the appropriation method and determines the eigenvectors and generalized elements directly by calculus from the forced response to a given frequency. J.M.S.

N80-17278 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

CALCULATION OF NATURAL FREQUENCIES AND MODE SHAPES OF MASS LOADED AIRCRAFT STRUCTURES **c05**

P. Wayne Whaley *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 13-20 (For primary document see N80-17275 08-31)

Avail: NRL, Tech. Inform. Div., Washington, D.C.

The problem of loaded random vibration response estimation using Galerkin's method, a direct method, and a generalized coordinates approach is examined. Results indicate that both the direct method and the generalized coordinates solution give very good estimates of the first four modes of a mass loaded simply supported beam, with the generalized coordinates solution giving better accuracy than the direct method. Galerkin's method gives unacceptable results. In addition, a matrix iteration scheme for computing loaded modes, given unloaded modes, is presented. Results show that over 50% reduction in execution time is possible in computing the first four modes, with good accuracy maintained. J.M.S.

N80-17279 Ballistic Research Labs., Aberdeen Proving Ground, Md.

ROCKET MOTOR RESPONSE TO TRANSVERSE BLAST LOADING **c20**

Norris J. Huffington, Jr. and Henry L. Wisniewski *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 21-32 refs (For primary document see N80-17275 08-31)

Avail: NRL, Tech. Inform. Div., Washington, D.C.

The effects of propellant inertia and of internal pressurization on the structural response of solid propellant rocket motors subjected to transverse air blast loading were investigated, both analytically and numerically. The numerical predictions were accomplished using the PETROS 3.5 computer program, which employs the finite difference method to solve the equations governing finite amplitude elastoplastic response of thin shells. The response of a typical rocket motor configuration was calculated for the limiting situations of the bare motor case and of the motor case containing the complete propellant grain, each with no internal pressurization and with the pressurization resulting from propellant combustion. These calculations showed that the unpressurized motors experience a much larger deformation than the pressurized motors for the same blast loading. The most significant result is the quantification of the greater vulnerability of rocket motors prior to their ignition, whether on the launcher or as upper stages of in-flight missiles. J.M.S.

N80-17280 Naval Underwater Systems Center, Newport, R. I.

EXPERIMENTAL AND THEORETICAL DYNAMIC ANALYSIS OF CARBON-GRAPHITE COMPOSITE SHELLS **c24**

A. Harari and B. E. Sandman *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 33-37 refs (For primary document see N80-17275 08-31)

Avail: NRL, Tech. Inform. Div., Washington, D.C.

A comparison between experimental and theoretical models of a carbon-graphite/honeycomb composite shell vibrating in air and submerged in water is presented. Mode shapes and resonant frequencies are identified according to theory and experiment both for in-air and in-water vibration. Excellent agreement is exemplified. Author

N80-17281 Martin Marietta Corp., Denver, Colo.

USE OF A SHOCK SPECTRA TO EVALUATE JITTER OF A FLEXIBLE MANEUVERING SPACECRAFT **c18**

William J. Kacena *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 39-47 refs (For primary document see N80-17275 08-31)

Avail: NRL, Tech. Inform. Div., Washington, D.C.

The effects of vibration on the operation of displacement sensitive spacecraft instruments are examined. The example presented is an optical pointing instrument that is vibrating because an orbital maneuver has just been performed. It is shown that a residual displacement shock spectrum of the rotational acceleration time history defines the vibration modes and the maneuvers which are critical to pointing accuracy. In addition, several realistic maneuvers are discussed and their effects on vibration are compared. J.M.S.

N80-17282 Waterloo Univ. (Ontario). Dept. of Civil Engineering.

BUCKLING OF EULER'S ROD IN THE PRESENCE OF ERGODIC RANDOM DAMPING **c39**

H. H. E. Leipholz *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 49-52 refs (For primary document see N80-17275 08-31)

Avail: NRL, Tech. Inform. Div., Washington, D.C.

For a small mean value of viscous damping, superposed by an ergodic random damping fluctuation, it is shown that for a sufficiently small expected value of the fluctuation's magnitude, almost certain asymptotic stability of the Euler rod can be guaranteed. Moreover, if the expected value does not exceed a certain fraction of the damping's mean value, the critical value of the load for deterministic damping remains the stability limit despite of the randomly superposed damping fluctuation. M.M.M.

N80-17283 Naval Underwater Systems Center, Newport, R. I.

WAVE PROPAGATION IN A CYLINDRICAL SHELL WITH JOINT DISCONTINUITY **c32**

A. Harari *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 53-61 refs (For primary document see N80-17275 08-31)

Avail: NRL, Tech. Inform. Div., Washington, D.C.

The frequency ranges where energy is transmitted or attenuated are analyzed for a cylindrical shell as well as the effects of the joints on the propagation of the wave. M.M.M.

N80-17284 Shock and Vibration Information Center (Defense), Washington, D. C.

RESPONSE TO MOVING LOADS OVER A CRYSTALLINE HALF-SPACE c39

Sasadhar De (Old Engineering Office, West Bengal, India) *In its* The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 63-70 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

The mathematical analysis to study the steady-state response to a line load moving with a constant speed over a crystalline half-space is considered. The half-space is composed of monoclinic, orthorhombic and cubic crystals. The solutions for the cases of supersonic, subsonic and transonic are investigated. The importance of the problem in crystal physics is pointed out as well as an application to study the motion of the ground composed of crystalline rocks under pressure waves generated by nuclear explosions. M.M.M.

N80-17285 Paris Univ. (France). Lab. de Mecanique Appliquee.

ADJUSTMENT OF A CONSERVATIVE NON GYROSCOPIC MATHEMATICAL MODEL FROM MEASUREMENT c35

L. Bugeat, R. Fillod, G. Lallement, and J. Piranda *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 71-81 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

A method is presented for calculating the modifications of a discrete, conservative model, which enables to reduce the distance between its dynamic behavior and the one identified on the physical structure. An initial approximate model is known and results from a discretization a priori, for example, by finite element method are obtained. The comparisons of the partial eigensolutions of this model, together with the corresponding eigensolutions identified on the physical structure, were used to locate the spatial area (or groups of degrees of freedom) where the initial model reveals dominant errors. The exploitation of the perturbation method was utilized to calculate the variations of the physical construction parameters, such that the modified model becomes, on a certain frequential field, dynamically similar to the physical structure. The results of a numerical similation are presented. M.M.M.

N80-17286 Kobe Univ. (Japan).

FIRST-PASSAGE FAILURE PROBABILITY IN RANDOM VIBRATION OF STRUCTURES WITH RANDOM PROPERTIES c39

N. Nakagawa, R. Kawai, and K. Funahashi *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 83-92 refs Prepared in cooperation with Kawasaki Heavy Industries Ltd., Japan (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

Nonstationary responses are generally analyzed for random vibration of structures which have random properties. Using the derivative method, statistical values of responses (mean function and autocovariance function) are obtained. The first passage failure probability is considered. It is assumed that a structure with random properties is subjected to a weakly stationary random excitation. Applying the average technique, the Fokker-Plank and the Kolmogorov backward equations are derived. Then, the first-passage failure probability is obtained. From numerical examples, it is found that it is necessary to consider the influence of the structural random properties, since it increases the first-passage failure probability. M.M.M.

N80-17287 General Electric Co., Utica, N. Y. Aircraft Equipment Div.

FRACTURE MECHANICS APPLIED TO STEP-STRESS FATIGUE UNDER SINE/RANDOM VIBRATION c39

Ronald G. Lambert *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 93-101 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

A proposed cumulative fatigue damage law is derived which uses fracture mechanics theory as its basis in order to predict the fatigue life of structures subjected to several levels of sequentially applied stress. The proposed law applies to all initial crack (i.e., flaw) sizes in the structure. The proper boundary condition to be imposed at the interface of the two stress regions is analyzed. Author

N80-17288 Concordia Univ., Montreal (Quebec).

RANDOM FATIGUE DAMAGE APPROACH TO MACHINERY MAINTENANCE c37

T. Seshadri Sankar, G. D. Xistrix, and G. L. Ostiguy *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 103-114 refs Prepared jointly with Ecole Polytechnique, Montreal (Quebec) (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

The amount of fatigue damage incurred as a result of stresses that occurred during operating conditions is computed using a linear damage accumulation law and expressions are developed for the expected value of the damage sustained over a specific time period. The behavior of these statistical parameters with operating time and with various system fatigue properties is discussed. The calculated damage provides a reliable indication of the remaining trouble free life and can be employed in the maintenance field to monitor the performance of industrial machinery. M.M.M.

N80-17289 California Univ., Berkeley.

CONSIDERATIONS FOR MAINTENANCE STRATEGIES FOR PORTLAND CEMENT CONCRETE PAVEMENTS Ph.D. Thesis

Donaldson Ross Macleod 1979 438 p
Avail: Univ. Microfilms Order No. 8000430

The requirements of a pavement management system for plain jointed Portland cement concrete pavements are studied. Ride deterioration caused by slab faulting (step-off) at the transverse joints, and slab breakup due to cracking are identified as the major distress mechanisms on California's plain jointed Portland cement concrete pavements. Four hundred lane miles of pavement were analyzed to establish a relationship between faulting index and ride quality. Guidelines for predicting faulting distress are presented. A mechanistic model is developed using finite element techniques in an analysis that considered variations in strength parameters and environmental conditions. Finally, a pavement management system is developed based on the findings of faulting and cracking performance. Excess user costs caused by faulting are compared to remedial costs of improving the ride. Dissert. Abstr.

N80-17290 Stanford Univ., Calif.

LIFELINE RESPONSE ANALYSIS UNDER NONSTATIONARY TRAVELING SEISMIC WAVE LOADING Ph.D. Thesis

Shayan Pazargadi 1979 213 p
Avail: Univ. Microfilms Order No. 8001990

A random vibration model of an above-the-ground lifeline system under nonstationary Gaussian traveling surface wave loading is presented as well as the wave passage effects on the response behavior of the system. The lifeline structure is modelled as a multi-input, multi-output linear time invariant filter with a set of stochastic inputs that represent the motions induced at the supports as a result of the wave passage across the lifeline. It was shown that the response values are very sensitive to the values of the surface wave velocity and therefore the phase difference between the support motions. In addition, the response values obtained for the stationary assumption of the input loading are in general larger than those of the nonstationary cases. Dissert. Abstr.

N80-17291 Stanford Univ., Calif.

MODEL TESTS ON EARTHQUAKE SIMULATORS: DEVELOPMENT AND IMPLEMENTATION OF EXPERIMENTAL PROCEDURES Ph.D. Thesis

Russell Scott Mills 1979 280 p
Avail: Univ. Microfilms Order No. 8001975

A comprehensive test study, encompassing material; subassembly and earthquake simulator tests, was performed to enable an accurate comparison of model and prototype response. Earthquake simulator tests utilized the El Centro 1940 North-South component and an artificial earthquake composed of discrete spectral components to excite the structure both elastically and inelastically. Accurate simulation of the prototype structure in terms of global and local response parameters was achieved.

The nature of prototype inelastic response was duplicated by the small scale model as characterized by yielding of the joint panel zones in shear and by comparison of the ductility demand and energy distribution of the respective structures. Observed minor discrepancies in model-prototype correlation can be explained by the larger weld sizes of the model and by the influence of earthquake simulator reproduction capabilities on test structure response. Dissert. Abstr.

N80-17292*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PRECISION HEAT FORMING OF TETRAFLUOROETHYLENE TUBING Patent
W. V. Ruiz (Rockwell International Corp., Downey, Calif.) and C. S. Thatcher, inventors (to NASA) (Rockwell International Corp., Downey, Calif.) Issued 18 Jan. 1980 11 p Sponsored by NASA
(NASA-Case-MSC-18430-1; US-Patent-Appl-SN-113015) Avail: NTIS HC A02/MF A01 CSCL 13H

A method is provided for altering the size of tetrafluoroethylene tubing which is only available in limited combination of wall thicknesses and diameter. The tetrafluoroethylene tubing is slid onto an aluminum mandrel to which the ends of the tubing are clamped. The tubing and mandrel are placed in a supporting coil which is then positioned in an insulated steel pipe. The steel pipe is normally covered with a fiber glass insulator to smooth out temperature distribution therein. The entire structure is then placed in an oven which heats the tetrafluoroethylene tubing and shrinks it to the outer dimension of the aluminum mandrel. After cooling, the aluminum mandrel is removed from the newly sized tetrafluoroethylene tubing by a conventional chemical milling process. NASA

N80-17293*# Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION BULLETIN. PART 3: STRUCTURE MEDIUM INTERACTION, CASE STUDIES IN DYNAMICS
Sep. 1979 97 p refs Presented at the 49th Symp. on Shock and Vibration, Washington, D.C., 17-19 Oct. 1978 Sponsored by NASA. Goddard Space Flight Center 3 Vol.
(NASA-CR-162473; AD-A074701; Bull-49-Pt-3) Avail: NTIS HC A05/MF A01 CSCL 20K

Structure and medium interactions topics are addressed. Topics include: a failure analysis of underground concrete structures subjected to blast loadings, an optimization design procedure for concrete slabs, and a discussion of the transient response of a cylindrical shell submerged in a fluid. Case studies in dynamics are presented which include an examination of a shock isolation platform for a seasparrow launcher, a discussion of hydrofoil fatigue load environments, and an investigation of the dynamic characteristics of turbine generators and low tuned foundations. For individual titles, see N80-17294 through N80-17302.

N80-17294*# Florida Univ., Eglin AFB.
FAILURE OF UNDERGROUND CONCRETE STRUCTURES SUBJECTED TO BLAST LOADINGS
C. A. Ross, P. T. Nash, and G. R. Griner *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 1-9 refs Prepared in cooperation with Air Force Armament Lab., Eglin AFB, Fla. (For primary document see N80-17293 08-31)
(Grant AF-AFOSR-3592-78)
Avail: NTIS HC A05/MF A01 CSCL 13M

The response and failure of two edges of free reinforced concrete slabs subjected to intermediate blast loadings are examined. The failure of the reinforced concrete structures is defined as a condition where actual separation or fracture of the reinforcing elements has occurred. Approximate theoretical methods using stationary and moving plastic hinge mechanisms with linearly varying and time dependent loadings are developed. Equations developed to predict deflection and failure of reinforced concrete beams are presented and compared with the experimental results. A.W.H.

N80-17295*# Naval Civil Engineering Lab., Port Hueneme, Calif.
OPTIMIZATION OF REINFORCED CONCRETE SLABS
J. M. Ferritto *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 11-22 refs (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 13M

Reinforced concrete cells composed of concrete slabs and used to limit the effects of accidental explosions during hazardous explosives operations are analyzed. An automated design procedure which considers the dynamic nonlinear behavior of the reinforced concrete of arbitrary geometrical and structural configuration subjected to dynamic pressure loading is discussed. The optimum design of the slab is examined using an interior penalty function. The optimization procedure is presented and the results are discussed and compared with finite element analysis. A.W.H.

N80-17296*# Naval Surface Weapons Center, White Oak, Md.
A NUMERICAL COMPARISON WITH AN EXACT SOLUTION FOR THE TRANSIENT RESPONSE OF A CYLINDER IMMERSED IN A FLUID c34
M. E. Giltrud and D. S. Lucas *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 23-28 refs (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 20D

The transient response of an elastic cylindrical shell immersed in an acoustic media that is engulfed by a plane wave is determined numerically. The method applies to the USA-STAGS code which utilizes the finite element method for the structural analysis and the doubly asymptotic approximation for the fluid-structure interaction. The calculations are compared to an exact analysis for two separate loading cases: a plane step wave and an exponentially decaying plane wave. A.W.H.

N80-17297*# Boeing Co., Renton, Wash. Marine Systems.
FOIL SYSTEM FATIGUE LOAD ENVIRONMENTS FOR COMMERCIAL HYDROFOIL OPERATION
D. L. Graves *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 29-40 refs (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 20K

The hydrofoil fatigue loads environment in the open sea is examined. The random nature of wave orbital velocities, periods and heights plus boat heading, speed and control system design are considered in the assessment of structural fatigue requirements. Major nonlinear load events such as hull slamming and foil unwetting are included in the fatigue environment. Full scale rough water load tests, field experience plus analytical loads work on the model 929 Jetfoil commercial hydrofoil are discussed. The problem of developing an overall sea environment for design is defined. State of the art analytical approaches are examined. A.W.H.

N80-17298*# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
EVALUATION OF ROTOR-BEARING SYSTEM DYNAMIC RESPONSE TO UNBALANCE c37
Roger E. Thaller and David W. Ozimek *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 41-53 refs (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 13I

The vibration environment within air conditioner rotating machinery referred to as an air cycle machine (ACM) was investigated to effectively increase ACM reliability. To assist in the selection of design changes which would result in improved ACM performance, various design modifications were incorporated into a baseline ACM configuration. For each design change, testing was conducted with the best balance achieveable (baseline) and with various degrees of unbalance. Relationships between unbalance (within the context of design changes) and the parameters associated with design goals were established. The results of rotor dynamics tests used to establish these relationships are presented. R.C.T.

N80-17299*# Rockwell International Corp., Los Angeles, Calif.
SELECTED TOPICS FROM THE STRUCTURAL ACOUSTICS PROGRAM FOR THE B-1 AIRCRAFT c05
Peter M. Belcher *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 55-68 refs (For primary document see N80-17293 08-31)

Avail: NTIS HC A05/MF A01 CSCL 01C

The major elements of the structural acoustics program for the B-1 aircraft are considered. Acoustic pressures measured at 280 sites on the surface of the vehicle were used to develop pressure models for a resizing of airframe components for aircraft No. 4 (A/C4). Acoustical fatigue design data for two dynamically complex structural configurations were acquired in laboratory programs, the conceptions for and executions of which detailed significant departures from the conventional. Design requirements for mechanical fasteners for configurations other than these two made use of analytical extensions of regrettably limited available information. R.C.T.

N80-17300*# Gilbert/Commonwealth, Jackson, Mich.

EXPERIMENTAL INVESTIGATION OF DYNAMIC CHARACTERISTICS OF TURBINE GENERATORS AND LOW-TUNED FOUNDATIONS c37

S. P. Ying, M. E. Forman, and R. R. Drumm *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 69-77 refs Prepared in cooperation with Pennsylvania Power and Light Co., Allentown (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 21E

Turbine generator (T-G) units with low tuned concrete foundations were investigated experimentally during both startup and normal operating conditions. The dynamic response of the turbine generators and their foundation systems were characterized by resonance curves obtained during the startup transient and by vibration mode shapes at the normal operating condition. No severe resonance at the fundamental frequencies of the system was observed. The deflection or displacement of the foundation pedestal does not lead to unacceptable T-G vibration. The experimental results are compared and discussed with some previous theoretical studies. R.C.T.

N80-17301*# McDonnell Aircraft Co., St. Louis, Mo.

COMBINED VIBRATION/TEMPERATURE/SIDELOAD ENVIRONMENTAL TESTING OF UHF BLADE ANTENNAS c39

Ronald Volker *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 79-84 (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 20K

Service problems encountered on the F-4 aircraft showed that the environmental qualification requirements for the UHF blade antenna were not adequate. Although the individual environmental levels were stringent enough, only combined environmental testing could duplicate the conditions in which service problems occurred. Techniques for applying static side load simultaneously with vibration and temperature were developed. The combined environment testing was instrumental in the rapid assessment of antenna modifications and resulted in a final configuration which proved satisfactory in service. A need to include combined environmental testing for qualification of blade antennas was established. Author

N80-17302*# Raytheon Co., Bedford, Mass. Missile Systems Div.

SHOCK ISOLATION PLATFORM FOR SEASPARROW LAUNCHER c15

Paul V. Roberts *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 85-95 refs (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 16A

A unique low frequency shock isolation platform is used to mount the NATO SEASPARROW Launcher aboard U.S. shock hardened ships. The platform attenuates shock response to less than structural design loads which were used to minimize weight on smaller NATO ships and for compatibility with airborne missiles. Author

N80-17303# Naval Postgraduate School, Monterey, Calif.

THE CONSISTENT SECOND-ORDER THEORY OF WAVE/STRUCTURE INTERACTION Final Report

C. J. Garrison Sep. 1979 45 p refs
(Grant NSF ENG-73-04019)
(AD-A076550; NPS-69-79-010) Avail: NTIS HC A03/MF A01 CSCL 13/13

The consistent second-order theory of the interaction of regular gravity waves with a fixed object in water of finite depth is developed. The theory is carried out for the most general case of a body of arbitrary shape which may extend through the free-surface or be completely immersed. The incident wave evolves in the development as a second-order Stokes' wave. Boundary-value problems are established for both the first- and second-order velocity potentials and a numerical method based on the Green's function is outlined. The determination of forces exerted by gravity waves on large structures immersed in the sea has become of great practical interest in recent years. For example, in the design of bottom-mounted oil storage facilities or large ocean caissons, the wave-induced horizontal and up-lift forces and overturning moments are factors of primary importance. The effect of large amplitude waves in particular is of importance in the determination of the permanence of an ocean structure and, therefore, a higher-order theory appears to have significant practical value. For example, Apelt and Macknight (1976) found measured forces on an ocean caisson model in fairly large-amplitude shallow-water waves to be considerably in excess of calculations based on linear diffraction theory. GRA

N80-17304# National Physical Lab., Teddington (England). Div. of Mechanical and Optical Metrology.

MASS FORCE AND WEIGHT

B. Swindells Mar. 1979 18 p refs
(NPL-MOM-38) Avail: NTIS HC A02/MF A01

The relationships among mass, force, and 'weight' are discussed and obsolescent units of force are reviewed. The procedure for finding the weight of a body using a spring balance or strain gage load cell is discussed. Author (ESA)

N80-17305# Centre Technique des Industries Mecaniques, Senlis (France).

ON THE SIMULATION OF FORMING PROCESSES Final Report [*SIMULATION DES PROCEDES DE MISE EN FORME*]

J. L. Montagut 19 Apr. 1979 64 p refs In FRENCH
(CETIM-1-3K-21-0) Avail: NTIS HC A04/MF A01

The laboratory simulation of forming processes using model materials is discussed. The choice of a simulation materials, its preparation, and the design of a machine to simulate the process under investigation is emphasized. Problems, such as the influence of friction on the similarity relationship and the use lubricants, are taken into consideration. A mathematical model of the simulation concept is presented, then used to analyze results obtained with a forging simulation setup. Theoretical results concerning other simulation exercise, notably viscoplasticity tests, are also compared with results from tests reported in the literature. Author (ESA)

N80-17306# Georgia Inst. of Tech., Atlanta. School of Civil Engineering.

STRENGTHENING OF REINFORCED CONCRETE COLUMNS FOR EARTHQUAKE RESISTANCE Final Report

Lawrence F. Kahn Jun. 1979 97 p refs
(Grant NSF ENG-77-06478)
(PB-300982/6; NSF/RA-790133) Avail: NTIS HC A05/MF A01 CSCL 13C

Several methods of strengthening reinforced concrete columns to improve their seismic resistance are described. Based on the test results and the ease of construction, it was concluded that U-clamp and banding techniques showed great promise in providing low cost, easy-to-construct methods for greatly improving the ductibility and earthquake resistance of existing reinforced concrete columns. Photographs showing column construction, reinforcement techniques, and results of testing are presented. GRA

N80-17307# Florida State Dept. of Transportation, Gainesville. Office of Materials and Research.

FLEXIBLE PAVEMENT DESIGN - (CHIEFLAND, CRESTVIEW, LAKE WALES, PALM BEACH, MARIANNA) REPORTS FOR STUDY P-1-63 Final Summary Data Reports, 1962 - 1978

R. L. McNamara Jun. 1979 50 p
(PB-301424/8; RR-196-A; FHWA/RD-79-S0896) Avail: NTIS HC A03/MF A01 CSCL 13B

A condensed version of the performance data generated and collected from five flexible pavement projects is presented. These five projects are considered to have fulfilled the requirements, but it is planned to continue the surveillance and evaluation of the completed projects to determine the long term behavior of Florida base course materials. GRA

N80-17308# California Univ., Richmond. Earthquake Engineering Research Center.

MECHANICAL BEHAVIOR OF LIGHTWEIGHT CONCRETE CONFINED BY DIFFERENT TYPES OF LATERAL REINFORCEMENT

Miguel A. Manrique (California Univ., Berkeley), Vitelmo V. Bertero (California Univ., Berkeley), and Egor P. Popov (California Univ., Berkeley) May 1979 123 p refs
(Grant NSF ENV-76-04263)
(PB-301114/5; UCB/EERC-79/05; NSF/RA-790183) Avail: NTIS HC A06/MF A01 CSCL 13C

Results are given of an experimental study to evaluate the different aspects of the behavior of lightweight concrete. The behavior of confined lightweight concrete when subjected to axial, monotonic loading was emphasized. The effects on confined concrete of the following parameters were considered: (1) concrete cover; (2) longitudinal reinforcement; and (3) lateral reinforcement arrangement. A total of 30 confined and unconfined specimens were tested. The effect of the mentioned parameters are evaluated; subsequently, the experimental results are compared with the results of a similar investigation carried out on normal weight concrete. An analytical stress-strain relationship for longitudinally reinforced confined lightweight concrete is presented. Practical design implications are presented. GRA

N80-17309# American Association for the Advancement of Science, Washington, D.C. Office of Public Sector Programs.

FIRE SAFETY AND DISASTER PREPAREDNESS

Mar. 1979 284 p refs Presented at the Workshop Considering Problems Identified by the Intergovernmental Sci. and Tech. Panel, Washington, D.C., 14-16 Mar. 1979
(Grant NSF OPA-78-24464)
(PB-300467/8; AAAS/Pub-79/R/3; NSF/RA-790096) Avail: NTIS HC A13/MF A01 CSCL 13L

Problems areas and their relationship to science and technology were discussed and analyzed. The problem areas considered were: (1) evaluation of fire prevention and suppression management; (2) causes and prevention of injury and disability among firefighters; (3) public awareness of fire hazards; and (4) disaster preparation planning. GRA

N80-17310# National Bureau of Standards, Washington, D.C. Center for Building Technology.

FIRE EFFECTS ON REINFORCED CONCRETE MEMBERS Final Report

Bruce Ellingwood and James Shaver Aug. 1979 44 p refs
(PB-299904/3; NBS/TN-985) Avail: NTIS HC A03/MF A01 CSCL 13M

Thermal and structural analyses for reinforced concrete members were validated using experimental data. Temperature distributions computed in reinforced concrete members for several realistic fire exposures were examined and compared to the distributions measured in a standard test. Parameter studies show the effect of typical variations in thermal diffusivity, emissivity and conductivity. Structural responses for the different fire exposures were also briefly compared. GRA

N80-17311# JACA Corp., Fort Washington, Pa.

EVALUATION OF THE ECONOMIC AND ENVIRONMENTAL FEASIBILITY OF USING FUSED AND UNFUSED INCINERATOR RESIDUE IN HIGHWAY CONSTRUCTION Final Report, 1978 - 1979

Uday M. Patankar, Emilio Palermo, Gary D. Gindlesperger, and Michael R. Taylor Apr. 1979 141 p refs
(Contract DOT-FH-11-9427)
(PB-300893/5; FHWA/RD-79/83) Avail: NTIS HC A07/MF A01 CSCL 13C

The use of residue in highway construction is discussed. The residue was evaluated for use as subbase material, in bituminous base and, in a fused state, as wearing course. Similar analysis was performed for disinterred residue from an existing landfill site. The results show that incinerator residue would prove competitive with virgin aggregate in highway construction in three of the five metropolitan areas studied. If the landfill savings gained by the municipality in using the incinerator residue are figured in, the use of the residue becomes economically attractive in all the SMSA's studied. GRA

N80-17312# Hawaii Univ. at Manoa, Honolulu. Dept. of Civil Engineering.

SYSTEM IDENTIFICATION OF TALL VIBRATING STRUCTURES Final Report

George T. Taoka Jul. 1979 124 p refs
(Grant NSF ENV-75-16926)
(PB-301064/2; NSF/RA-790173) Avail: NTIS HC A06/MF A01 CSCL 13M

Ambient vibration responses under natural wind conditions of five tall structures in Tokyo and Yokohama were recorded. The ambient data obtained were analyzed by four system identification methods: filtered correlation, spectral moments, spectral density, and two-stage least square. Factors that greatly affect the values of parameters estimates obtained from the ambient vibration record are record length, signal-noise ratio in the record, filter shape, and filter cutoff bandwidth. GRA

N80-17313# National Technical Information Service, Springfield, Va.

CORROSION OF REINFORCED CONCRETE, VOLUME 1. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - 1977

William E. Reed Nov. 1979 248 p
(PB80-800790) Avail: NTIS HC $30.00/MF $30.00 CSCL 13C

Citations from worldwide journal reports on concrete deterioration by corrosion are presented. Studies on bridge decks, offshore structures, buildings, and industrial plants are covered. Inhibition and prevention of this process by coatings, additives, impregnation, and steel thermomechanical treatment are also included, as are the testing and performance of concrete under corrosive conditions. This updated bibliography contains 285 abstracts, none of which are new entries to the previous edition. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N80-17314 Maryland Univ., College Park.

A NEW CLASS OF MULTI-ACCESS PROTOCOLS FOR PACKET COMMUNICATION OVER A SATELLITE CHANNEL: THE INTERLEAVED FRAME FLUSH-OUT PROTOCOLS Ph.D. Thesis

Jeffrey Ernest Wiesethier 1979 252 p
Avail: Univ. Microfilms Order No. 8002073

A class of protocols, known as the Interleaved Frame Flush-Out (IFFO) protocols are introduced. These protocols combine random access and reservation techniques, and use a slotted variable length frame structure which adapts to instantaneous system traffic. Numerical and simulated results were obtained for the IFFO protocols. It is demonstrated that the delay-through-put performance of both F-IFFO and CR*IFFO is better than that of previously proposed schemes over a wide range of applications, and that stability is guaranteed as long as the input rate is less than one packet per slot. Dissert. Abstr.

N80-17315 Princeton Univ., N. J.

SOME NEW TECHNIQUES AND PERFORMANCE ANALYSES IN DIGITAL SIGNAL PROCESSING Ph.D. Thesis

David Clair Munson 1979 190 p
Avail: Univ. Microfilms Order No. 7928483

Structures with greatly reduced arithmetic roundoff error are implemented using multiplierless ROM-accumulator (ROM/ACC) arithmetic. The N/S ratios are derived for these realizations using a ROM/ACC error analysis and are shown to be small. In addition, an example demonstrates that the ROM/ACC realizations may require as little as one half the ROM wordlength and operate at up to twice the word rate of direct form ROM/ACC realizations that achieve the same S/N. Error spectrum shaping, a technique which utilizes quantizer feedback to reduce the effect of roundoff error, is shown to reduce limit cycle amplitudes in digital filters. Assuming ROM/ACC arithmetic, an expression for the MSE in an ESS filter is also derived, including the effect of finite wordlength ROM. The problem of generating a random sequence with a specified marginal distribution and autocovariance is also investigated. Dissert. Abstr.

N80-17316 California Univ., Berkeley.
PENETRATION AND SCATTERING OF ELECTROMAGNETIC FIELDS BY ADVANCED COMPOSITE BODIES OF REVOLUTION Ph.D. Thesis
Hugh Kao 1979 106 p
Avail: Univ. Microfilms Order No. 8000396

A numerical algorithm based on the unimoment method is developed for the computation of electromagnetic (EM) response of advanced composites. The unimoment approach is characterized by the mathematical division of space into an interior and exterior region. With the advanced composites modeled by a permittivity tensor, the Maxwell's equations in the interior region are specialized to a coupled partial differential equation valid for inhomogeneous, anisotropic, axial-symmetric media. The finite element method is used to obtain the interior solutions corresponding to a set of linearly independent boundary trial functions. Such a procedure has the effect of generating the inverse differential operator that governs the interior solution. In the exterior region, the scattered fields are analytically represented by a series expansion having unknown coefficients. With appropriate enforcement of continuity conditions, the solution to the EM field penetration and scattering problem is obtained. Dissert. Abstr.

N80-17317 Ohio State Univ., Columbus.
A COMPUTATIONAL MODEL FOR SUBSURFACES PROPAGATION AND SCATTERING FOR ANTENNAS IN THE PRESENCE OF A CONDUCTING HALF SPACE Ph.D. Thesis
Curtis Woodward Davis 1979 280 p
Avail: Univ. Microfilms Order No. 8001716

Techniques are presented which can be used to model a wide variety of underground radar probing methods and scatterer types. Antenna properties and medium propagation effects are modeled using a thin wire computational procedure which are modified to allow the impedance altering effects of the conducting interface to be accounted for. The resulting modified antenna currents are treated as radiating in a homogeneous conducting medium. Target scattering behavior is modeled by scattering attenuation functions (SAF) which are computed separately from the aforementioned antenna model. The SAFs are presented which represent the scattering from doubly curved surfaces and long cylinders. The modification of underground electromagnetic fields incident upon the interface is accounted for by the development of interface correction functions. Dissert. Abstr.

N80-17318 Ohio State Univ., Columbus.
RADIATION BY SOURCES ON PERFECTLY CONDUCTING CONVEX CYLINDERS WITH AN IMPEDANCE SURFACE PATH Ph.D. Thesis
Levent Ersoy 1979 133 p
Avail: Univ. Microfilms Order No. 8001726

An asymptotic high frequency analysis of the radiation patterns of a magnetic line source, or a magnetic line dipole, located on a uniform impedance surface patch which partly covers an electrically large perfectly conducting convex cylinder is presented. Radiation pattern calculations based on this analysis compare quite well with a numerical moment method type solution, a previous GTD solution for those impedances which support an Elliot mode, and also with some experimental results. A moderately large increase in the radiation intensity is obtained in the vicinity of the horizon for cylinders loaded by an impedance surface which support Elliot type modes. This work is relevant to the analysis of fuselage mounted airborne antennas for satellite communication purposes. Dissert. Abstr.

N80-17319 Stanford Univ., Calif.
MONOLITHIC POWER-SPECTRUM CENTROID DETECTOR Ph.D. Thesis
Levy Gerzberg 1979 225 p
Avail: Univ. Microfilms Order No. 8001922

Systems and integrated circuit technologies related to the applications, theory, and realization of a monolithic power spectrum centroid detection was investigated. Optimal system configurations and new monolithic devices was developed to enable detector realization in integrated circuit form. Detection schemes for the operation of single sideband detectors for directional velocity and flow estimation were introduced. The square root of f centroid detector was selected for implementation and use based on theoretical estimation errors derived for the correlation and the square root of f centroid detectors, plus the need for versatility and integrated circuit realization. This detector verifies its versatility, accuracy, and good agreement with theoretical performance. Dissert. Abstr.

N80-17320# RAND Corp., Santa Monica, Calif.
LIMITATIONS ON TOA ACCURACY
T. Finley Burke Sep. 1979 14 p
(Contract F49620-77-C-0023)
(P-6386) Avail: NTIS HC A02/MF A01

A directional antenna is a filter whose response varies with direction. A modulated signal transmitted from such an antenna produces different far-field waveforms in all directions (except for possible symmetry). The response of a receiver to the transmission will vary with position in the antenna pattern of the emitter. The system performance of a rudimentary time of arrival (TOA) system consisting of three identical receivers was examined. The analysis indicates that in a simple idealized TOA system that would otherwise be entirely free from error, the waveform effect arising from a directional emitter can lead to errors of several dozen meters in the computed location. R.E.S.

N80-17321*# Mitre Corp., Houston, Tex.
TMS COMMUNICATIONS HARDWARE. VOLUME 1: COMPUTER INTERFACES
J. S. Brown and S. S. Weinrich Feb. 1979 37 p refs
(NASA Order T-5295-F)
(NASA-CR-160449; MTR-H721-Vol-1; JSC-14682) Avail: NTIS HC A03/MF A01 CSCL 17B

A prototpye coaxial cable bus communications system was designed to be used in the Trend Monitoring System (TMS) to connect intelligent graphics terminals (based around a Data General NOVA/3 computer) to a MODCOMP IV host minicomputer. The direct memory access (DMA) interfaces which were utilized for each of these compters are identified. It is shown that for the MODCOMP, an off-the-shell board was suitable, while for the NOVAs, custon interface circuitry was designed and implemented. J.M.S.

N80-17322*# Mitre Corp., Houston, Tex.
TMS COMMUNICATIONS HARDWARE. VOLUME 2: BUS INTERFACE UNIT
J. S. Brown and G. T. Hopkins Mar. 1979 36 p refs
(NASA Order T-5295-F)
(NASA-CR-160450; MTR-4721-Vol-2; JSC-14723) Avail: NTIS HC A03/MF A01 CSCL 17B

A prototype coaxial cable bus communication system used in the Trend Monitoring System to interconnect intelligent graphics terminals to a host minicomputer is described. The terminals and host are connected to the bus through a microprocessor-based RF modem termed a Bus Interface Unit (BIU). The BIU hardware and the Carrier Sense Multiple Access Listen-While-Talk protocol used on the network are described. J.M.S.

N80-17323*# Mitre Corp., Houston, Tex.
TMS COMMUNICATIONS SOFTWARE. VOLUME 1: COMPUTER INTERFACES
J. S. Brown and M. D. Lenker Apr. 1979 81 p refs
(NASA Order T-5295-F)
(NASA-CR-160451; MTR-4723-Vol-1; JSC-14792) Avail: NTIS HC A05/MF A01 CSCL 17B

A prototype bus communications system, which is being used to support the Trend Monitoring System (TMS) as well as for evaluation of the bus concept is considered. Hardware and software interfaces to the MODCOMP and NOVA minicomputers are included. The system software required to drive the interfaces in each TMS computer is described. Documentation of other software for bus statistics monitoring and for transferring files across the bus is also included. J.M.S.

N80-17324*# Mitre Corp., Houston, Tex.
TMS COMMUNICATIONS SOFTWARE. VOLUME 2: BUS INTERFACE UNIT
Paul J. Gregor Apr. 1979 110 p refs
(NASA Order T-5295-F)
(NASA-CR-160452; MTR-4723-Vol-2; JSC-14793) Avail: NTIS HC A06/MF A01 CSCL 17B

A data bus communication system to support the space shuttle's Trend Monitoring System (TMS) and to provide a basis for evaluation of the bus concept is described. Installation of the system included developing both hardware and software interfaces between the bus and the specific TMS computers and terminals. The software written for the microprocessor-based bus interface units is described. The software implements both the general bus communications protocol and also the specific interface protocols for the TMS computers and terminals. J.M.S.

N80-17325*# Mitre Corp., Houston, Tex.
DIAGNOSTIC PROCEDURES FOR TREND MONITORING SYSTEM (TMS) COMMUNICATIONS
J. S. Brown and M. D. Lenker Mar. 1979 37 p refs
(NASA Order T-5295-F; Contract F19628-79-C-0001)
(NASA-CR-160453; MTR-4724; JSC-14794) Avail: NTIS HC A03/MF A01 CSCL 17B

A prototype coaxial cable bus communications sytem was developed to support the trend monitoring system (TMS). Troubleshooting procedures are described at the system level. The procedures can be used by repair personnel to isolate a fault in the TMS and to restore the system to operation by swapping out failed components. R.E.S.

N80-17326*# Mitre Corp., Houston, Tex.
TREND MONITORING SYSTEM (TMS) GRAPHICS SOFTWARE
J. S. Brown Apr. 1979 93 p
(NASA Order T-5295-F)
(NASA-CR-160454; MTR-4725; JSC-14795) Avail: NTIS HC A05/MF A01 CSCL 17B

A prototype bus communications systems, which is being used to support the Trend Monitoring System (TMS) and to evaluate the bus concept is considered. A set of FORTRAN-callable graphics subroutines for the host MODCOMP comuter, and an approach to splitting graphics work between the host and the system's intelligent graphics terminals are described. The graphics software in the MODCOMP and the operating software package written for the graphics terminals are included. J.M.S.

N80-17327*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ALTERNATIVE BEAM EFFICIENCY CALCULATIONS FOR A LARGE-APERTURE MULTIPLE-FREQUENCY MICROWAVE RADIOMETER (LAMMR)
R. F. Schmidt Dec. 1979 33 p refs Submitted for publication
(NASA-TM-80603) Avail: NTIS HC A03/MF A01 CSCL 20N

The fundamental definition of beam efficiency, given in terms of a far field radiation pattern, was used to develop alternative definitions which improve accuracy, reduce the amount of calculation required, and isolate the separate factors composing beam efficiency. Well-known definitions of aperture efficiency were introduced successively to simplify the denominator of the fundamental definition. The superposition of complex vector spillover and backscattered fields was examined, and beam efficiency analysis in terms of power patterns was carried out. An extension from single to dual reflector geometries was included. It is noted that the alternative definitions are advantageous in the mathematical simulation of a radiometer system, and are not intended for the measurements discipline where fields have merged and therefore lost their identity. R.C.T.

N80-17328*# LinCom Corp., Pasadena, Calif.
SHUTTLE/TDRSS COMMUNICATIONS SYSTEM PERFORMANCE ANALYSIS Final Report, 20 Apr. 1979 - 24 Jan. 1980
W. R. Braun 24 Jan. 1980 126 p refs
(Contract NAS9-15799)
(NASA-CR-160467; TR-0180-1179) Avail: NTIS HC A07/MF A01 CSCL 17B

The results of the performance analysis performed on the Shuttle/Tracking and Data Relay Satellite System (TDRSS) communications system are presented. The existing Shuttle/TDRSS link simulation program were modified and refined to model the post-radio frequency interference TDRS hardware and to evaluate the performance degradation due to RFI effects. The refined link models were then used to determine, evaluate and assess expected S-band and Ku-band link performance. Parameterization results are presented for the ground station carrier and timing recovery circuits R.E.S.

N80-17329# Naval Ocean Systems Center, San Diego, Calif.
TADIXS OCEAN NETWORK PLAIN. A PROPOSAL FOR THE FCC-TO-TFCC SATELLITE LINKAGE VIA TADIXS FOR EACH FCC AREA OF OPERATIONS Final Report, 1 Apr. - 1 Jun. 1979
J. L. Dodd, C. T. Ogata, and W. J. Pomper 1 Jun. 1979 20 p
(AD-A076560; NOSC/TR-440) Avail: NTIS HC A02/MF A01 CSCL 17/2

The objective of this study was to develop an ocean network plan to show (1) the Tactical Data Information Exchange System (TADIXS) ocean coverage assigned to each Fleet Command Center (FCC) and (2) the communications concepts required to assure FCC-to-TFCC linkage throughout the ocean area responsibility of each FCC. A network plan was developed that allows FCC-TFCC communication for all locations within the area of responsibility of each FCC. System backup for the loss of a uhf satellite is discussed; uhf and narrowband shf backups are considered and effects analyzed. GRA

N80-17330# Naval Ocean Systems Center, San Diego, Calif.
DESIGN OF SHIPBOARD HF ANTENNAS FOR BROADBAND CHARACTERISTICS
R. L. Goodbody 1 Sep. 1979 18 p refs
(AD-A076539; NOSC/TD-286) Avail: NTIS HC A02/MF A01 CSCL 09/1

Typical US Navy ships have 5 to 19 hf transmitters and 6 to 24 or more hf receivers which must all be capable of operating simultaneously without mutual interference. Achieving this capability is made difficult by rf currents induced on all the complex conducting shapes on the structure when electromagnetic energy is radiated or received. The topside in effect acts as a complex antenna. The topside has some highly undesirable shapes from the point of view of the antenna designer. Prominent ship features such as corners, masts, and yard-arms have a strong effect on hf antenna characteristics. The antenna designer must therefore be sophisticated in the use of rf filters and in the placement and control of hf antennas and rf conductors in the ship's topside. This document provides guidance in design of broadband hf antennas on ships. It will be useful to engineers not familiar with Navy shipboard hf antenna systems. It will also be useful to shipyard engineers in the determination of antenna construction techniques. GRA

N80-17331# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
SATCOM EHF AIRBORNE TERMINAL AVAILABILITY TO COST ANALYSIS DEMONSTRATION Technical Report, Jul. 1978 - Apr. 1979
Herbert M. Bartman Jul. 1979 150 p refs
(AD-A076163; AFAL-TR-79-1105) Avail: NTIS HC A07/MF A01 CSCL 17/2

A practical approach (TASA/DEPEND Program) for analyzing system 'ilities' was demonstrated based on results reported in Technical Reports AFAL-TR-78-45 and AFAL-TR-78-135. This approach provides an analysis tool for studying the impact of changes in mission use on reliability, availability and dependability so that mission plans can be optimized with respect to achieving design objectives as related to cost. An important feature of this analysis approach is that the impact of malfunctions and failures on system availability and cost are separately assessed. This makes it possible to directly relate the contributions of hardware module reliability and maintainability to functional block performance. Such studies provide a means for concentrating reliability and maintainability resources in areas that will provide the maximum system improvement at the minimum cost. Also, a relational basis for trade-offs between reliability and maintainability requirements is obtained in relationship to cost. GRA

N80-17332# Defense Communications Engineering Center, Reston, Va.
DELAY ANALYSIS OF TASI WITH RANDOM FLUCTUATIONS IN THE NUMBER OF VOICE CALLS
M. J. Fischer Sep. 1979 34 p refs
(AD-A076172; AD-E100296; DCEC-TN-15-79) Avail: NTIS HC A03/MF A01 CSCL 17/2

In this technical note we consider the performance of a voice communications system where the talkspurts of a conversation are buffered and multiplexed over the transmission channels. A mathematical model is given for the behavior of a talkspurt in the system when the voice calls are allowed to statistically come and go. A numerical analysis is conducted to determine the sensitivity of various system measures of performance to the presence of voice calls and to relate various measures of performance. GRA

N80-17333# Electronics Research Lab., Adelaide (Australia).
THE EFFECT OF SCINTILLATIONS OF TRANSIONOSPHERIC COMMUNICATIONS
D. G. Singleton Apr. 1979 42 p refs
(AD-A076182; ERL-0074-TR) Avail: NTIS HC A03/MF A01 CSCL 20/14

Consideration is given to the bearing ionospheric scintillation on the design and on the evaluation of the performance of satellite communication links. Emphasis is placed on establishing a design parameter of universal application. The cumulative amplitude distribution function (cdf), which was found application in this regard, is shown experimentally to be well represented by the Nakagami m-distribution at all scintillation levels. However, the cdf is demonstrated to be strictly valid only for amplitude modulated signals of short duration. Autocorrelation, power spectra and level crossing techniques are investigated in an effort to establish a design parameter more universally applicable than the cdf. A quantity message reliability is defined which removes the short duration restriction inherent in the cdf. A formula for message reliability is developed which allows it to be evaluated for any fade margin and message length, given the scintillation index and the half width of the autocorrelogram of the scintillating channel. A design chart, embodying this information, is also illustrated. GRA

N80-17334# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MINIMUM DIRECTIVE GAIN OF HOPPED-BEAM ANTENNAS
Andre R. Dion 11 Jun. 1979 30 p refs
(Contract F19628-78-C-0002; AF Proj. 2029)
(AD-A076495; TN-1979-33; ESD-TR-79-158) Avail: NTIS HC A03/MF A01 CSCL 09/5

The optimum parameters of an antenna whose beam is hopped to uniformly spaced directions within a circular coverage are derived for a phased array and for a multifeed lens antenna. The minimum directive gain, GMIN, within the coverage is the parameter optimized. The analysis shows that, for small bandwidth-diameter products, the two antenna configurations exhibit about the same GMIN, but the optimum aperture diameter is about 30 percent smaller with the phased array. However, as the bandwidth-diameter product increases, the GMIN of the lens antenna becomes progressively greater than that of the phased array. GRA

N80-17335# New Jersey Inst. of Technology, Newark.
RADIATION FROM INTEGRATED DIELECTRIC MILLIMETER-WAVE SLAB-WEDGE STRUCTURES Final Technical Report, 29 Jan. 1976 - 31 May 1979
G. M. Whitman, S. J. Maurer, and A. R. Noerpel (Bell Telephone Labs., Holmdel, N.J.) Oct. 1979 80 p refs
(Grants DAAG29-76-G-0131; DAAG29-77-G-0094)
(AD-A076504; ARO-13677.2-ELX) Avail: NTIS HC A05/MF A01 CSCL 20/14

A method of analysis of an integrated dielectric slab waveguide and wedge radiator is presented. Plane wave constituents in the slab are assumed to excite the dielectric wedge. The solution in the wedge is postulated to be a finite, continuous spectrum of plane waves. Reflections of these waves from the wedge boundaries are taken into account by introducing angularly dependent Fresnel reflection coefficients into the integrands of the planewave integral representations. These integrals reduce asymptotically to the dielectric slab fields in the limit of small wedge apex angle at the interface between the slab and the wedge. Using numerical techniques, the TE surface fields and the far field radiation patterns are determined for different dielectric materials, wedge lengths and slab widths. It is observed that by decreasing either the relative permittivity of the dielectric or the slab width or by increasing the wedge length a more directive antenna pattern results. GRA

N80-17336# E-Systems, Inc., St. Petersburg, Fla. ECI Div.
ELECTRONICALLY TUNED UHF RECEIVER PRESELECTOR Final Technical Report, 27 Oct. 1977 - 30 Oct. 1978
Thomas Swanson Griffiss AFB, N.Y. RADC Aug. 1979 106 p refs
(Contract F30602-77-C-0200; AF Proj. 2338)
(AD-A075286; RADC-TR-79-210) Avail: NTIS HC A06/MF A01 CSCL 17/2

This report describes design and construction of a prototype improved electronically tunable UHF receiver preselector for interference reduction in Air Force communication systems. This research work was directed toward developing the technology for frequency agile preselectors to protect solid state receivers from high level signals originating from colocated UHF transmitters. The design approach consists of tuning a modified comb-line filter structure with high Q UHF capacitors and pin diode switches. Equations and design considerations are given for construction of tuning networks which have Cx2 to the Nth power binary capacitance steps. A computer program was used to predict the filters' performance based on the values of stray capacitance and inductance of the tuning networks. The tuning networks were then optimized which ensured that spurious resonances fell well outside of the tuning range of the filters. The filters were built based on these computer modeled results. Test data showed input VSWR variation versus the tuning frequency of the filters. These changes were found to be caused by variation in current loading at the tap point of the resonator resulting from the different values of capacitance selected in the tuning network. Improved filter performance was obtained by grounding the input transformers in the vicinity of the tuning network tap point. GRA

N80-17337# Rome Air Development Center, Griffiss AFB, N.Y.
SPREAD-SPECTRUM DATA LINK TEST FACILITY
Oscar H. McKee Aug. 1979 53 p refs
(AD-A075098; RADC-TR-79-244) Avail: NTIS HC A04/MF A01 CSCL 09/5

This technical report describes the development of an in-house capability for evaluating wide bandwidth spread spectrum modems. The major portion of the report concerns the development and fabrication of the microwave transmitting and receiving equipment used during the flight testing of a direct sequence spread spectrum modem developed to RADC specifications. The microwave equipment developed for the test facility operated at an IF of 300 MHz, with four distinct RF frequencies of 4500 MHz, 4900 MHz, 7350 MHz and 7900 MHz. The output power for all stations was set at 200 watts CW, however, additional power is available at the three ground stations. Section 2 of the report presents the theoretical calculations used to predict the maximum range expected from each of four data links incorporated in a five station test scenario. The maximum theoretical range was calculated to be 414.3 miles, however, the ranges achieved during actual flight testing were approximately 9 dB below theoreteical expectations. GRA

N80-17338# Raytheon Co., Goleta, Calif. Electromagnetic Systems Div.
FEED LENS PORTION OF 3-D DOME ANTENNA STUDY Final Report, 1 Oct. 1973 - 3 Apr. 1979

David T. Thomas and S. Douglas Bixler Oct. 1979 104 p refs
(Contract N00014-77-C-0760)
(AD-A076298) Avail: NTIS HC A06/MF A01 CSCL 09/5

A 3-D Dome/Rotman Lens Antenna system is described which offers the capability for greater than hemisphere scan coverage from a single feed array, greater than octave bandwidth, and multiple simultaneous beams. The history and selected results of related programs are included. Results of the analysis performed show peak phase errors of 15 degrees for scanning in the major axis planes. This error level would produce about 28 dB peak sidelobe levels for low sidelobe distributions. Complete descriptions of the analysis, computer programs and results are included. GRA

N80-17339# George Washington Univ., Washington, D. C. School of Engineering and Applied Science.
RADAR BACKSCATTER FROM A VEGETATED TERRAIN: A DISCRETE SCATTERING APPROACH
Roger H. Lang and Spiro P. Sokolakis Jun. 1979 65 p refs
(Contract DAAK70-77-C-0142; DA Proj. 4A1-61102-B-52C)
(AD-A076249; ETL-0159) Avail: NTIS HC A04/MF A01 CSCL 17/9

This report studies radar backscattering from a vegetated terrain. The vegetation is modelled by spherical water droplets which can be treated as discrete scatterers. The vegetation is assumed sufficiently lossy so that the underlying ground is not noticeable. The method of Foldy is used to evaluate the mean field in the vegetation when the wavelength of the incident radiation is large compared to the droplet size. Once an equivalent dielectric constant for the vegetation is obtained by the Foldy technique, single scattering is employed to evaluate the backscattering cross section. The resulting expression is found to compare favorably with experimental data. In addition to the three dimensional work, a one dimensional problem is analyzed. This analysis is compared with the Foldy approximation in the high density limit. GRA

N80-17340# Lincoln Lab., Mass. Inst. of Tech., Lexington.
TURBULENCE EFFECTS ON THE RECEIVER OPERATING CHARACTERISTICS OF A HETERODYNE-RECEPTION OPTICAL RADAR
Barbara A. Capron, Jeffrey H. Shapiro, and Robert C. Harney Jul. 1979 97 p refs
(Contract F19628-78-C-0002; AF Proj. 649L)
(AD-A076535; TST-33; ESD-TR-79-189) Avail: NTIS HC A05/MF A01 CSCL 17/9

The theory of atmospheric turbulence effects on the receiver operating characteristics of coherent optical radars is reviewed and the theoretical results for the target detection probability are numerically evaluated. Graphs and tables are presented of the glint target and speckle target detection probabilities as a function of the carrier-to-noise ratio at various false alarm probabilities for different turbulence log-amplitude variances. Experimental turbulence strength measurements are reviewed and used to determine typical log-amplitude variances. These results are combined with the detection probability calculations to predict the performance of a realistic infrared radar under a variety of turbulent propagation conditions. GRA

N80-17341# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
MILLIMETER RADAR SEA RETURN STUDY Final Technical Report, Feb. - Oct. 1978
Robert N. Trebits Apr. 1979 48 p refs
(Contract N60921-77-C-A168)
(AD-A075516; GIT-EES-A-2013-FTR) Avail: NTIS HC A03/MF A01 CSCL 17/9

A site selection process was performed for a planned field exercise to measure radar sea clutter reflectivity at low grazing angles using several radar frequencies between 9.5 and 95 GHz. A detailed test plan was developed to collect calibrated radar cross section data over a variety of geometric and environmental conditions. The data collection and calibration processes have been described using radar systems and ancillary electronic equipment. GRA

N80-17342# Air Force Weapons Lab., Kirtland AFB, N. Mex.
ELECTROMAGNETIC PULSE INTERACTION NOTES--EMP 3-38 Final Report
Carl E. Baum Kirtland AFB, N.M. AFWL May 1979 488 p refs
(AF Proj. 9996)
(AD-A073770; AD-E200329; AFWL-TR-79-401) Avail: NTIS HC A21/MF A01 CSCL 20/14

This is a series of five notes on electromagnetic pulse interaction. Subjects covered in this volume are: electromagnetic shielding by advanced composite materials; fields in a rectangular cavity excited by a plane wave on an elliptical aperture; transient electromagnetic characterization of arbitrary conducting bodies through an aperture-perforated conducting screen; a comparison of stick model skin current predictions with scale model measurements for the E-4 and EC-135 aircraft; aperture excitation of a wire in a rectangular cavity. GRA

N80-17343# Los Alamos Scientific Lab., N. Mex.
APPLICATION OF PADE APPROXIMANTS TO ELASTIC WAVE SCATTERING
J. E. Gubernatis 1979 7 p refs Presented at ARPA/AF Review of Progress in Quantitative NDE, La Jolla, Calif., 8 Jul. 1979
(Contract W-7405-eng-36)
(LA-UR-79-1902; CONF-790757-1) Avail: NTIS HC A02/MF A01

Several Pade methods were used to try to accelerate the convergence of partial wave sums for scattering amplitudes. A specific test problem of longitudinal-to-longitudinal scattering from a spherical void was studied in detail. Results for this test case and the behavior of partial wave amplitudes for general cases are presented and discussed. DOE

N80-17344# Electrical Research Association, Leatherhead (England). RF Technology Centre.
DEFINITION OF AN ANTENNA CONFIGURATION FOR TVBS COVERAGE OF SMALL COUNTRIES Final Report
N. Adatia and B. Claydon Mar. 1979 29 p refs
(Contract ESTEC-3687/78-NL-PP)
(RFTC-821078; ESA-CR(P)-1231) HC A03/MF A01

Radiation characteristics and mechanical design criteria are presented for a carbon fiber reflector representative of non-furlable satellite antennas. The solid reflector was designed to fit within the Ariane shroud in the single launch mode and to provide a .6 deg and .6 deg beam for coverage of small countries in the 11.7 to 12.5 GHz band. Reflector designs were based on the use of a rectangular corrugated horn as a primary feed. Author (ESA)

N80-17345# Universite Catholique de Louvain (Belgium). Lab. de Telecommunications et d'Hyperfrequences.
STUDY OF PROPAGATION EFFECTS CAUSING DEGRADATION TO SYNTHETIC APERTURE RADAR PERFORMANCE
A. Guissard and M. Rognoni Jun. 1979 119 p refs
(Contract ESTEC-3688/78-NL-AK(SC))
(ESA-CR(P)-1236) Avail: NTIS HC A06/MF A01

An analysis of the influence of tropospheric turbulence in clear air on phase fluctuations and resolution of an SAR system is presented. The solution of the plane wave equation in a homogeneous medium is reviewed and the results extended to a spherical wave in a locally homogeneous medium. The limits of validity imposed by the approximations are discussed. A survey of the structure constant models and records is presented, and two profiles, depicting alleged worst case conditions, are used to estimate the phase structure function on the synthetic aperture. The possible effects of precipitation, clouds, ducts, and the bright band are considered. Author (ESA)

N80-17346# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
ON THE SELF CONFINEMENT OF ELECTROMAGNETIC RADIATION
B. Lehnert Jul. 1979 23 p refs
(TRITA-EPP-79-13) Avail: NTIS HC A02/MF A01

A theoretical approach which examines the rest mass of particles as eigenmodes of self confined electromagnetic radiation is discussed. An extended interpretation of Maxwell's equations is used. A case in which the particle interior contains a unipolar like electric field having a nonvanishing divergence and coupled to a poloidal dipole like magnetic field with a non-vanishing curl is examined. Numerical order of magnitude estimations based on this model are compared with experimentation data for the electron and the proton. Author (ESA)

N80-17347# Admiralty Experiment Works, Haslar (England).
IDENTIFYING THE MARINE VEHICLE FROM THE PULSE RESPONSE
T. B. Booth London HMSO 1975 14 p refs Presented at 4th Ship Control System Symp., The Hague, Oct. 1975
(BR69339) Avail: NTIS HC A02/MF A01

The application of systems identification techniques for establishing the stability and control characteristics of marine vehicles using a record of their response to a pulse maneuver is examined. Equations of disturbed motion for lateral motion and vertical motion (in the case of submersibles) as well as the effects of fluid memory on hydrodynamic force increments are considered. Results show that the motion is represented by a linear transfer operator. The application of the analysis to artificial records is reported. Author (ESA)

N80-17348# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
MEASUREMENT OF RADIATION PATTERNS OF AIRCRAFT ANTENNAS IN NON-STEADY FLIGHT
D. C. Schering and H. Tellegen 10 Feb. 1979 28 p refs
(NLR-TR-78018-U) Avail: NTIS HC A03/MF A01

Methods for measuring radiation patterns of aircraft antennas are described. During pitch and roll maneuvers radiation in the symmetry respective lateral plane of the aircraft is recorded. Diagrams of the horizontal plane are obtained by a semi-stationary method; a circular track with wings level is flown at a relatively large distance from the ground station. During the time that the maneuvers are being carried out only small parts of the ground antenna diagram are needed and the effect of the shape of this pattern is reduced to a scale factor; the brief time involved also minimizes the influence of a varying distance, changes in environment conditions, and of equipment characteristics. The effect of reflection from the Earth's surface is reduced by the use of an artificial ground plane and by optimization of the configuration of the receiving antennas. The methods were applied to a Fokker F-27 transport aircraft in a version containing nine different aerials. A fair reduction in flying time is obtained over the well-known standard method of 'flying along'.
Author (ESA)

N80-17349# National Technical Information Service, Springfield, Va.
MODEMS, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1974 - 1977
William E. Reed Nov. 1979 221 p
(PB80-800568) Avail: NTIS HC $30.00/MF $30.00 CSCL 17B

Reports are cited on the design, operating principles, and applications of modems, with applications to data transmission, digital voice communication, and satellite communications. The bibliography contains 258 abstracts. GRA

N80-17283 Naval Underwater Systems Center, Newport, R. I.
WAVE PROPAGATION IN A CYLINDRICAL SHELL WITH JOINT DISCONTINUITY
A. Harari *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 53-61 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-17350 Stanford Univ., Calif.
PARAMETERS CONTROLLING THE PHOTOVOLTAIC PROPERTIES OF THE COPPER SULFIDE/CADMIUM SULFIDE HETEROJUNCTION Ph.D. Thesis
William George Haines 1979 139 p
Avail: Univ. Microfilms Order No. 8001933

The parameters controlling the photovoltaic properties of the Cu2S/CdS heterojunction were investigated. Results indicate that the behavior of the short circuit current and the open circuit voltage are describable in terms of a deep, donor-like level in the CdS region adjacent to the metallurgical interface. The relative probability of tunneling from this level to the Cu2S is derived, as is the probability of tunneling from the level to the CdS conduction band. Dissert. Abstr.

N80-17351 Cincinnati Univ., Ohio.
INFRARED EXTRINSIC MOSFET DETECTOR WITH AND WITHOUT MEMORY, BASED UPON EPITAXIAL SILICON/GERMANIUM ALLOY Ph.D. Thesis
Chih-Sieh Teng 1979 198 p
Avail: Univ. Microfilms Order No. 8002144

The terminal characteristics of the photodetector and the basic characteristics of the gold impurity centers were analyzed and demonstrated. It is found that the photoresponse is negative or positive and depends on the operational modes (with and without preset), relative doping concentrations and the bias-applied conditions. The experimental results match the theoretical predictions. An attempt to examine the effects of infrared radiation on gold impurity centers in a p-channel MOSFET fabricated on Si/Ge alloy is reported. A shift in the gold energy level was obtained. The possibility for arbitrary selection of wavelength for maximal response through the control of permittivity, by the use of epitaxial alloys is pointed out. Dissert. Abstr.

N80-17352 California Univ., Berkeley.
TRANSPORT THEORY OF HIGH-FREQUENCY RECTIFICATION IN SCHOTTKY BARRIERS Ph.D. Thesis
Dah Wen Tsang 1979 172 p
Avail: Univ. Microfilms Order No. 8000549

A theory based on the Boltzmann equation is used to study rectification by Schottky barriers at frequencies as high as infrared. Taking short range particle collision and long range Coulombic interaction into consideration and employing a second-order perturbation analysis, charge densities, fields, and currents are calculated as a function of frequency. Typically, it is found that rectification is nearly constant from zero frequency to the plasma frequency of the bulk semiconductor, then drops. A reversal of the sign of the rectification current is predicted near omega sub p. The small signal impedance of the junction is calculated as a function of frequency. The theory is extended to mixing of two weak signals and mixer output is calculated as a function of heat frequency. It is found that this output can be much larger than the value one would estimate from the ideal diode equation due to a parametric or varactor effect. Dissert. Abstr.

N80-17353 Stanford Univ., Calif.
APPLICATION OF POLYVINYLIDENE FLUORIDE TO MONOLITHIC SILICON/PVF2 TRANSDUCER ARRAYS Ph.D. Thesis
Robert Gerald Swartz 1979 218 p
Avail: Univ. Microfilms Order No. 8002021

The construction of one-and two-dimensional arrays for medical ultrasonic imaging is described, including the design and fabrication of front-matching layers and two-component backings which are efficient attenuators of reverberation. Impedance matching is improved by polyvinylidene fluoride (PVF2). A POSFET receiving transducer employs this material as the piezoelectric sensing element. The performance of this device is analyzed theoretically, and the broadband consequences of the lambda/4 resonant mode of operation are demonstrated. A large clinical-prototype POSFET array was constructed. This array achieves a 72 dB dynamic range, + or - 22 deg acceptance angle, 200 kHz to 6 MHz spectral operating range, and an impulse response unmatched by any other array technology. The multiple-layer technique is investigated as a means of generating a large acoustic output, and current-source electrical drive is proposed for a PVF2 transmitter. Dissert. Abstr.

N80-17354 California Univ., Berkeley.
APPLICATIONS OF INFORMATION THEORY TO IMAGE ENCODING Ph.D. Thesis
Dimitris Anastassiou 1979 139 p
Avail: Univ. Microfilms Order No. 8000271

Various descriptions of random fields defined on a discretized raster are considered. A finite number (usually equal to 2) of possible tones is assumed, thus permitting the determination of random curves at the boundaries between regions of lattice sites with different intensity levels. These models are extensions of one dimensional Markov chains. Theorems pertaining to the entropy rate of such random fields are presented and typical sample fields with appearance which reasonably approximate the shape of random curves defined by the edges of objects in an image are generated. Near-optimum encoding strategies applied to these models are devised. A way to describe a single random curve together with expressions of interesting quantities pertaining to the description is presented. Dissert. Abstr.

N80-17355 California Univ., Berkeley.
REMOTE SENSING OF DIELECTRIC MEDIUM Ph.D. Thesis
Shimon Coen 1979 130 p
Avail: Univ. Microfilms Order No. 8000309

A remote sensing technique for the estimation of the dielectric and conductivity profile of an inaccessible stratified half space is presented. The data was the reflected power from the inaccessible region, due to normally incident plane waves at various discrete frequencies. The problem was posed as a nonlinear Fredholm integral equation of the first kind, where the dielectric and conductivity profile of the inaccessible half space was sought. The equation was solved approximately by developing a Quasi Newton method in functional space. The Backus and Gilbert resolving power theory was used to estimate the resolution and certainty of the results. Results are given for the reconstruction of various dielectric and conductivity profiles from an artificial data, together with resolving kernels and local averages estimates. Dissert. Abstr.

N80-17356 Rutgers - The State Univ., New Brunswick, N. J.
ELECTRON-BEAM EVAPORATED SILICON FILMS FOR MIS PHOTOVOLTAICS: PROPERTIES OF FILMS AND DEVICES Ph.D. Thesis
Alan Edward Delahoy 1979 193 p
Avail: Univ. Microfilms Order No. 7928393

The feasibility of extending MIS (metal insulator semiconductor) photovoltaic technology to vacuum deposited, thin film polycrystalline silicon is demonstrated. Rectifying MIS junctions, exhibiting strong photovoltaic response, are formed on high purity, boron doped silicon films produced by electron beam evaporation. The physical and electrical properties of the films are investigated, and device properties analyzed. The dissolution of Si by the Al layer, and the subsequent formation of Si growth centers at the surface of the Al layer, is extensively documented by scanning electron microscopy studies. A model is proposed relating the surface density of growth centers to the initial Si incidence rate. The relation of the growth centers to the observed columnar growth is discussed. Dissert. Abstr.

N80-17357# Federal Aviation Administration, Washington, D. C. Systems Research and Development Service.
FIELD IMPACT EVALUATION REPORT ON THE ELECTRONIC TABULAR DISPLAY SUBSYSTEM (ETABS) Final Report, Dec. 1978 - Jul. 1979
Oct. 1979 52 p
(AD-A078848; FAA-RD-79-101) Avail: NTIS HC A04/MF A01 CSCL 14/2

A team of field personnel from air traffic and airways facilities conducted an impact assessment of the projected implementation of the electronic tabular display subsystem (ETABS) at air route control center. Alternatives were developed which could be expected to reduce or eliminate the negative consequences identified which could result from ETABS implementation. Six impact areas are addressed. These are: impact on the workforce, technological considerations, implementation, operations, training, and logistics support. Conclusions and recommendations as to the most desirable alternative solutions from a field viewpoint are presented. A.R.H.

N80-17358*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE PERFORMANCE OF THE MARTIN DIGITAL FILTER FOR HIGH-AND LOW-PASS APPLICATIONS
Charles R. McClain Oct. 1979 30 p refs Submitted for publication
(NASA-TM-80593) Avail: NTIS HC A03/MF A01 CSCL 09A

A nonrecursive numerical filter is described in which the weighting sequence is optimized by minimizing the excursion from the ideal rectangular filter in a least squares sense over the entire domain of normalized frequency. Additional corrections to the weights in order to reduce overshoot oscillations (Gibbs phenomenon) and to insure unity gain at zero frequency for the low pass filter are incorporated. The filter is characterized by a zero phase shift for all frequencies (due to a symmetric weighting sequence), a finite memory and stability, and it may readily be transformed to a high pass filter. Equations for the filter weights and the frequency response function are presented, and applications to high and low pass filtering are examined. A discussion of optimization of high pass filter parameters for a rather stringent response requirement is given in an application to the removal of aircraft low frequency oscillations superimposed on remotely sensed ocean surface profiles. Several frequency response functions are displayed, both in normalized frequency space and in period space. A comparison of the performance of the Martin filter with some other commonly used low pass digital filters is provided in an application to oceanographic data. M.G.

N80-17359*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MAGNETIC FIELD CONTROL Patent Application
Walter Haeussermann, inventor (to NASA) Filed 11 Jan. 1980 12 p
(NASA-Case-MFS-23828-1; US-Patent-Appl-SN-111436) Avail: NTIS HC A02/MF A01 CSCL 09C

A torque control an electromechanical torquing device of a type where a variable clearance occurs between a rotor and field is presented. A Hall effect device senses the field present, which would vary as a function of spacing between field and rotor, and the output of the Hall effect device controls the power applied to the field so as to provide a well-defined field and thus a controlled torque to the rotor which is well defined. NASA

N80-17360# California Univ., Berkeley. Dept. of Physics.
SIS QUASIPARTICLE JUNCTIONS AS MICROWAVE PHOTON DETECTORS
P. L. Richards, T. M. Shen, R. E. Harris (NBS, Boulder, Colo.), and F. L. Lloyd (NBS, Boulder, Colo.) Dec. 1979 12 p refs Submitted for publication
(Contract N00014-75-C-0496)
(AD-A076590) Avail: NTIS HC A02/MF A01 CSCL 20/10

The strong nonlinearity of the quasiparticle tunneling current in superconductor-insulator-superconductor junctions near the full gap voltage 2 Delta/e can be used for direct detection of microwave signals. Measurements at 36 GHz yielded a current responsivity of 3.5000 A/W, which is within a factor of 2 of the quantum limited value e/h-bar omega. The measured NEP of 2.6 - or - 0.8 x 10 to the -16th power W/sq-rt. Hz is the lowest value reported to date and can probably be improved significantly. The experimental results are compared with both the standard classical analysis and photon assisted tunneling theory. GRA

N80-17361# Army Electronics Research and Development Command Fort Belvoir, Va. Night Vision and Electro-Optics Labs

OVERVIEW OF PULSE-HEIGHT ANALYSIS OF IMAGE INTENSIFIER TUBES Final Report, Nov. 1977 - Sep. 1978
Byong H. Ayn Jun. 1979 64 p refs
(AD-A076155; DELNV-TR-0006) Avail: NTIS
HC A04/MF A01 CSCL 09/5

Pulse-height analysis (PHA) of image intensifier tubes (I2 tube) is described using a multiple-channel analyzer (MCA). The experimental setup, schematics of I2 tubes, statistics and mathematics for the analysis, and methods for data acquisition and reduction are included in the report. PHA complements another experimental technique which measures the noise figure (N(f)) of an I2 tube by explaining causes for good or bad performance of the tube. Technical developments of I2 tubes over the years were retraced to point out the improvements or the distinctions of a later generation I2 tube over an earlier one. Some of the tube characteristics are described in detail when they affect the N(f) or the gain noise figure. Background mathematics and statistics are illustrated, and some useful oscilloscope traces are given. GRA

N80-17362# Bogue Electric Mfg. Co., Patterson, N.J.
DC TEST RIG PROPULSION MOTOR Final Report
Sylvain Garnett May 1979 58 p refs
(Contract DAAK70-78-C-0044)
(AD-A074960) Avail: NTIS HC A04/MF A01 CSCL 09/3

This project's mission was to design, construct and evaluate two high speed dc propulsion motors with a nominal rating of 10Hp at 6000 rpm and an intermittent rating of 20Hp at 3000 rpm at a motor weight of 95lbs/unit. The motors are designed for use in conjunction with either a conventional dc chopper motor controller, or as dual motor drive in conjunction with a two phase, sequentially switched dc chopper motor controller. The auxiliary shunt field is used to synchronize speed between the two motors and to assist the series field during the regenerative brake mode. GRA

N80-17363# GenRad, Inc., Concord, Mass.
AUTOMATIC MICROCIRCUIT BRIDGE AND AUTO-BALANCING UNIT Final Report, Jun. 1976 - May 1977
William F. Byers, Robert J. Hanson, and William J. Riley May 1979 74 p refs
(Contract DAAB07-76-C-1380; DA Proj. 1S7-62705-AH-94)
(AD-A075921; DELET-TR-76-1380-F) Avail: NTIS
HC A04/MF A01 CSCL 09/1

This report summarizes the design and test of a Microcircuit Bridge and Balancing Unit to be used in a precision measurement of quartz crystal resonators. Design goals for the Bridge and Balancing Unit were to measure resistance with a 5% accuracy and capacitance with a + or - 0.1 pF accuracy from .8 to 220 MHz and at temperatures from -50 C to +105 C. The autobalance Unit will perform initial balance, final balance, and plus/minus susceptance offset on command. Based on the measured data, it will be possible to calculate the Q of the crystal resonator being tested. GRA

N80-17364# Hughes Aircraft Co., Fullerton, Calif.
SEMI-ADDITIVE PROCESSES FOR FABRICATION OF PRINTED WIRING BOARDS Final Report, 1 Jul. 1976 - 31 Dec. 1978
Jack Quintana Jun. 1979 141 p refs
(Contract DAAK01-76-C-1100)
(AD-A075975; FR-79-12-190) Avail: NTIS HC A07/MF A01
CSCL 09/1

Printed wiring boards fabricated by semi-additive processes from four laminate types have met the requirements of MIL-P-13949, MIL-P-5110, and selected tests of MIL-P-55640. Laminate types consisted of ultra-thin copper with peelable carrier, ultra-thin copper with etchable carrier, sacrificial foil, and adhesively-coated nonclad. GRA

N80-17365# Fulmer Research Inst. Ltd., Stoke Poges (England).
FIELD EMISSION COLD CATHODE DEVICES BASED ON EUTECTIC SYSTEMS Interim Report, 1 May 1977 - 30 Apr. 1978
Duncan Stewart, Paul D. Wilson, and Vivian G. Rivlin Griffiss AFB, N.Y. RADC Jul. 1979 40 p refs
(Grant AF-AFOSR-3292-77; AF Proj. 4600)
(AD-A075066; R744/2; RADC-TR-79-170) Avail: NTIS
HC A03/MF A01 CSCL 09/1

A survey has been made of the performance as field emission cold cathodes of selected refractory materials fabricated as needle arrays by unidirectional solidification. Specially designed apparatus was used to observe the operating lifetimes and Fowler-Nordheim functions of needle arrays of niobium carbide, tantalum carbide in a nichrome matrix and of a gamma/gamma primed - alpha eutectic in the Ni Mo Ta Al system. The results are co-related with SEM observations. Thermodynamic stabilities under the operating conditions are discussed. GRA

N80-17366# Thermal Technology Labs., Buffalo, N. Y.
DEVELOPMENT OF LIGHTWEIGHT TRANSFORMERS FOR AIRBORNE HIGH POWER SUPPLIES Final Report, Jul. 1976 - Mar. 1979
James P. Welsh Jun. 1979 69 p refs
(Contract F33615-75-C-2014; AF Proj. 3145)
(AD-A076215; AFAPL-TR-79-2049) Avail: NTIS
HC A04/MF A01 CSCL 09/5

Emphasis on this program was on the development of high voltage, high power, high frequency, low specific weight, inverter transformers. A primary intent was the reduction of specific weight without sacrifice of either electrical performance or reliability. Research was conducted into the characteristics of magnetic and dielectric materials, improved magnetic circuit modeling, and application of advanced heat transfer techniques. Computer-aided design methods were utilized and specialized programs were developed to permit extensive manipulation of multiple design parameters. GRA

N80-17367# Texas Univ. at Austin. Dept. of Chemistry.
SEMICONDUCTOR ELECTRODES, 26: SPECTRAL SENSITIZATION OF SEMICONDUCTORS WITH PHTHALOCYANINE
Calvin D. Jaeger, Fu-Ren F. Fan, and Allen J. Bard Oct. 1979 31 p refs Submitted for publication
(Contract N00014-78-C-0592)
(AD-A076149; TR-4) Avail: NTIS HC A03/MF A01 CSCL 20/12

Spectral sensitization by metal-free phthalocyanine (H2Pc) films was observed on various semiconductor electrodes (single crystal n-TiO2, n-SrTiO3, n-WO3, n-ZnO, n-CdS, n-CdSe, nOSi, and n-GaP; SnO2 conducting glass). The spectral response of the sensitized photocurrent was generally the same as the absorption spectrum of the phthalocyanine. The rather thick (400 A to 1 micron H2Pc films showed both anodic and cathodic photocurrents depending upon the applied potential. The anodic photocurrents represented the usual sensitization of the n-type semiconductor, while the cathodic photocurrents were attributed to p-type behavior of the phthalocyanine itself. The current-potential curves of the semiconductor electrodes depended on the nature of the H2Pc film, the presence of a redox couple (i.e., p-hydroquinone/p-benzoquinone) in solution and the wavelength of the irradiating light. The magnitude of the steady state sensitized photocurrent was linear with light intensity and was strongly affected by the addition of the supersensitizer.GRA

N80-17368# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
TRANSIENT-THERMAL BEHAVIOR OF PULSED HIGH POWER IMPATT AND TRAPATT DIODES Final Technical Report, 12 Apr. 1976 - 11 Apr. 1979
John W. Amoss 12 Jun. 1979 106 p refs
(Grant DAAG29-76-G-0202)
(AD-A073578; ARO-13775.2-ELX) Avail: NTIS
HC A06/MF A01 CSCL 20/12

Results of an analytical investigation of transient and steady state temperature and current profiles within the active region of a variety of IMPATT structures are presented. The analyses are based on thermal models which assume power dissipation distributions with an axial dependence proportional to the electric field intensity E(z) and a radial dependence proportional to the local current density j(r). Examples are presented in which the local current density is assumed to decrease with the local temperature. The temperature gradients within the active region depend strongly on the doping profile. These analyses show that the maximum temperature at the edge of the active region can be as much as 25% higher than at the center of the avalanche region, especially for high efficiency, high power structures where the ionization is highly localized and the electric field intensity in the drift region is sufficiently high to prevent unsaturated drift velocities and depletion-layer modulation. Breakdown calculations using temperature dependent ionization coefficients and axial temperature profiles suggest that actual temperatures within a device can be significantly higher than those measured experimentally by using a predetermined breakdown voltage vs temperature calibration curves. GRA

N80-17369# Naval Research Lab., Washington, D. C.
DESIGN MANUAL FOR A CONSTANT BEAMWIDTH TRANSDUCER Interim Report
A. L. VanBuren 11 Oct. 1979 34 p refs
(RR0110842)
(AD-A076971; AD-E000330; NRL-8329) Avail: NTIS HC A03/MF A01 CSCL 17/1

The theory of a broadband constant beamwidth transducer (CBT) which is based on Legendre function amplitude shading of a spherical cap was described in a previous report, J. Acoust. Soc. Am. 64:38-43 (1978). Theoretical calculations showed the CBT to have uniform acoustic loading, extremely low side-lobes, virtually no nearfield, an essentially constant beam pattern for all frequencies above a certain cutoff frequency, and a flat transmitting current response over a broad band for piezoelectric drive. In this report formulas suitable for the design of a CBT which is to be used as a transmitter and/or receiver are developed. The formulas involve simple algebraic and trigonometric expressions and can be readily evaluated using a pocket calculator. Formulas are developed for the required velocity distribution, limiting beam patterns, directivity index, equivalent two-way beam widths for volume and surface reverberation, shading coefficients for a stepwise implementation of the velocity distribution, size, ceramic mass, bandwidth, source level, transmitting voltage and current responses, and receiving voltage sensitivity. The report concludes with an example illustrating the procedure used to design a CBT with a specified - 3 dB half-angle beam pattern, source level, and receiving voltage sensitivity. GRA

N80-17370# AEG-Telefunken, Heilbronn (West Germany).
OPTOELECTRONICS. PART A: TECHNOLOGY OF OPTOELECTRONIC EMITTERS Final Report
Diethard Huber Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 56 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. 3 Vol.
(BMFT-FB-T-78-42) Avail: NTIS HC A04/MF A01; Fachinformationzentrum, Karlsruhe, DM 11,35

A survey of electro-optical devices is presented. Technology and fabrication advances are reported. The developments of various LEDs and IREDs are described. IR diodes (lambda = 930 nm), fast IR diodes (100 MHz), IR diodes made of GaAlAs, red emitting diodes (GaAsP, lambda = 660 nm), and yellow and green emitting diodes (GaP, lambda = 560 nm; GaAsP, lambda = 590 nm) are highlighted. Performance tests and manufacturing techniques are described. Author (ESA)

N80-17371# AEG-Telefunken, Heilbronn (West Germany).
OPTOELECTRONICS. PART B: TECHNOLOGY OF OPTOELECTRONIC RECEIVERS Final Report
Klaus Berchtold Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 79 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. 3 Vol.
(BMFT-FB-T-78-43) Avail: NTIS HC A05/MF A01; Fachinformationzentrum, Karlsruhe, DM 16,40

A survey of electro-optical devices is presented. Advances in technology and fabrication are reported. The development of special detectors based on silicon for the wavelength range 0.4 microns to 1 micron is presented. The packaging and measuring techniques tailored to electro-optical requrements are discussed. Methods and possibilities of dectector integration are examined. Emphasis is placed on photo pin diodes and photo avalanche diodes with extremely high gain bandwidth products (260 GHz), sensor cells, photo transistors, photo darlingtons, and monolithic integrated detector devices. The manufacturing techniques of the electro-optical components are reported. Author (ESA)

N80-17372# AEG-Telefunken, Heilbronn (West Germany).
OPTOELECTRONICS. PART C: TECHNOLOGY OF OPTOCOUPLERS Final Report
Werner Schoeberl Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 62 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. 3 Vol.
(BMFT-FB-T-78-44-Pt-C) Avail: NTIS HC A04/MF A01; Fachinformationzentrum, Karlsruhe, DM 12,60

A survey of electro-optics is presented. Recent advances in technology and fabrication are reported. The development of various electro-optic couplers is described with emphasis on couplers with very high coupling ratios (600 percent), couplers with high frequency limits (1 to 2 MHz), couplers with high isolation capability (10 kV), and combinations for signal coupling over distances using fiber optics or diffuse radiation (IR remote control). Extensive performance tests results as well as a discussion of manufacturing techniques elaborated during the development of these electro-optical components are given. Author (ESA)

N80-17373# Toulouse Univ. (France). Lab. de Genie Electrique.
ON THE MECHANISM OF DISCHARGE PROPAGATION AT THE SURFACE OF AN ELECTROLYTE
A. M. Rahal, J. C. Labadie, and C. Huraux 1978 15 p refs Presented at 1978 Conf. on Elec. Insulation and Dielec. Phenomena, Pocono Manor, Pa., 1978
(Publ-360) Avail: NTIS HC A02/MF A01

A graphical interpretation of critical flashover conditions and a detailed experimental study of the phenomenon are presented. A mechanism governing flashover, a force acting on the dicharge column, is proposed. Experiments show the existence of this force and responsibility for flashover. Author (ESA)

N80-17374# Toulouse Univ. (France). Lab. de Genie Electrique.
STUDY OF THE EVOLUTION OF ELECTRICAL TREEING BY OBSERVATION OF LUMINOUS PHENOMENA AND DISCHARGE DETECTION
C. Laurent and C. Mayoux 1978 6 p refs Presented at 1978 Conf. on Elec. Insulation and Dielec. Phenomena, Pocono Manor, Pa.
(Publ-361) Avail: NTIS HC A02/MF A01

Results obtained from the observation of discharge characteristics for different treeing types as well as the time dependent evolution of accompanying light phenomena were studied. The experimental apparatus, consisting of a microscope (400 X) and a camera, are described and the experimental procedure outlined. Results demonstrate the occurance of light emission due to the existence of discharge under the studied voltage conditions. The evolution of the light in the electrode gap was revealed through the use of an image intensifier. The same aging conditions as those reported in the literature for an air filled gap were also observed. Author (ESA)

N80-17375# Toulouse Univ. (France). Lab. de Genie Electrique.
BEHAVIOR OF COMPOSITE INSULATION UNDER THE ACTION OF SUPERFICIAL ARCS. APPLICATION TO LINE INSULATORS Final Report [TENUE DES ISOLANTS COMPOSITES A L'ACTION DES ARCS SUPERFICIELS - APPLICATION AUX ISOLATEURS DE LIGNE]
Bui Ai, C. Huraux, and A. M. Rahal Dec. 1978 21 p refs In FRENCH
(Publ-378) Avail: NTIS HC A02/MF A01

Laboratory measurements were made in order to define the flashover mechanism observed on high voltage line insulators. Surface discharge propagation is considered to be due to the build-up of pollutants on the insulator surface. The laboratory apparatus, consisting of an open channel filled with an electrolyte, is described. This device represents a linear model of the electric equation under study. Variables are arc length, extent of polluted surface, and type as well as resistance of the electrolyte. Results determine experimentally the lowest voltage at which an arc sufficient to short-circuit the electrolyte develops. Some possible applications of this data to the improvement of insulators are then discussed. Author (ESA)

N80-17376# Research Inst. of National Defence, Linkoeping (Sweden).
X-BAND FET AMPLIFIERS FOR APPLICATIONS IN PHASE ARRAYS. VOLUME 1: TEXT [X-BANDS FET-EFFEKTFOERSTAARKARE FOER TILLAAMPNING I GRUPP-ANTENNER. DEL 1]
Herbert Steyskal Jun. 1979 57 p refs In SWEDISH; ENGLISH summary 2 Vol.
(FOA-C-30156-E1-Vol-1) Avail: NTIS HC A04/MF A01

Characteristics of X-band GaAs-FET power amplifiers, based on measurements of actual devices, are reported. Two types of amplifiers are discussed: (1) a commercial amplifier with 100 mW CW output; and (2) breadboard model with 1 W CW output. Data of relevance to applications in phased arrays were measured in CW and ICW operation. Emphasis was on the dependence of phase on operating voltage, signal power, and temperature. Measurement techniques are described. The tests demonstrate suitable characteristics for applications in active modules for phased arrays. The amplifiers are shown to be superior to equivalent diode amplifiers in regards to efficiency and phase data. Author (ESA)

N80-17377# Research Inst. of National Defence, Linkoeping (Sweden).
X-BAND FET AMPLIFIERS FOR APPLICATIONS IN PHASED ARRAYS. VOLUME 2: TABLES AND GRAPHS [X-BANDS FET-EFFEKTFOERSTAARKARE FOER TILLA AMPNING I GRUPPANTENNER. DEL 2: FIGURE OCH TABELLER]
Herbert Steyskal Jun. 1979 37 p In SWEDISH; ENGLISH summary 2 Vol.
(FOA-C-30156-E1-Vol-2) Avail: NTIS HC A03/MF A01

Characteristics of X-band GaAs-FET power amplifiers, based on measurements of actual devices, are reported. Two types of amplifiers are discussed. One is a commercial amplifier with 100 mW cw output and the other is a breadboard model with 1 W cw output. Data of relevance to application in phased arrays were measured in cw and icw operation. Emphasis was on the dependence of phase on operating voltage, signal power, and temperature. Measurement techniques are described. The tests demonstrate suitable characteristics for applications in active modules for phased arrays. The amplifiers are shown to be superior to equivalent diode amplifiers in regards to efficiency and phase data. Author (ESA)

N80-17378# AEG-Telefunken, Heilbronn (West Germany).
OPTOELECTRONICS. PART C: LIGHT EMITTING DIODES (Ga CRYSTALS) Final Report
Gunter Raab Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 77 p refs In GERMANY; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. 5 Vol.
(BMFT-FB-T-78-36) Avail: NTIS HC A05/MF A01; Fachinformationzentrum Karlsruhe, DM 15.95

In preparation for eventual production on an industrial scale, the synthesis of GaP and the growth of single crystals was developed to allow larger charges than were previously possible. The pressure vessel developed for the synthesis of charges up to 1 kg proved, in practice, to be satisfactory for initial loads yielding up to 1.5 kg of polycrstaline materials. The liquid encapsulated growth of the monocrystals was achieved in a high pressure crystal pulling apparatus. This allowed the production of monocrystals with a weight up to 0.7 kg and up to 2 inches in diameter which were not only reproducible, but could also be treated further. Author (ESA)

N80-17379# AEG-Telefunken, Heilbronn (West Germany).
OPTOELECTRONICS. PART D: OPTOELECTRONIC EMITTER AND DETECTOR ARRAYS Final Report
Heinz Haemmerling Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 87 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. 5 Vol.
(BMFT-FB-T-78-45) Avail: NTIS HC A05/MF A01; Fachinformationzentrum, Karlsruhe DM 18.10

Techniques for integration of optoelectronic devices and displays are described. The integration of emitters was carried out in three steps. These were the hybrid integration of chips for seven segment displays (red, green, yellow), hybrid integration in the form of functional displays with up to 1250 picture points, and monolithic integration in a matrix. Arrays of phototransistors incorporating duodiodes were also developed for decoding purposes. Author (ESA)

N80-17380# AEG-Telefunken, Heilbronn (West Germany).
OPTOELECTRONICS. PART E: FABRICATION OF 3-5 COMPOUNDS FOR OPTOELECTRONIC DEVICES Final Report
Wolfgang Gramann Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 108 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. 5 Vol.
(BMFT-FB-T-78-46) Avail: NTIS HC A06/MF A01; Fachinformationzentrum, Karlsruhe, DM 22.30

Gallium phosphide crystal growth, either by a liquid encapsulated Czochralski method or by a synthesis solute diffusion method, is discussed. Principles of liquid phase epitaxy and gas phase epitaxy are then compared. The necessary reactors and apparatus for this work are extensively described, starting with their design and including in service adjustments. Emphasis is on the differences between vapor phase epitaxial techniques for the fabrication of red, green, and yellow LED's and liquid phase epitaxy used in the production of materials for GaP green LED's and for IR emitting diodes (GaAs, Si, and GaAlAs) Author (ESA)

N80-17381# Compagnie Generale d'Electricite, Marcoussis (France). Div. Energie.
EFFECT OF A ROTATION MAGNETIC FIELD AROUND A BUNDLE OF NIOBIUM-TITANIUM FILAMENTS Final Report [EFFET D'UN CHAMP MAGNETIQUE TURNANT SUR DES BRINS COMPOSITES A BASE DE FILAMENTS DE NIOBIUM TITANE]
Alain Fevrier Sep. 1978 32 p In FRENCH
(Contract DGRST-77-7-1384)
Avail: NTIS HC A03/MF A01

Superconductor losses due to a rotating magnetic field were studied. An experiment was set up to verify a formula derived to predict these losses by analog with the losses produced by a variation in the induction amplitude. A previously developed computer program was extended to calculate these losses as a time series function of a variable amplitude magnetic field. Comparison of measured results with calculated predictions shows that losses from hysteresis in a rotating field can be determined to within 10% while induction current losses at relatively low rotational speeds are given to within 20%. Author (ESA)

N80-17382# Compagnie Generale d'Electricite, Marcoussis (France). Div. Energie.
DEVELOPMENT OF A LINE SUPERCONDUCTOR MADE OF NIOBIUM CARBONITRIDE FILAMENTS Final Report [BRIN SUPRACONDUCTEUR A BASE DE FILAMENTS DE CARBONITRURE DE NIOBIUM]
B. Letellier, F. Gaillet, and Jr. Trottier Sep. 1978 31 p In FRENCH
(Contracts DGRST-76-7-1761; DGRST-76-7-1762)
Avail: NTIS HC A03/MF A01

A technique for the vapor deposition of niobium carbonitride on an inert substrate in the form of a filament (dia. 7 microns) was developed. The bundling of these filaments and their impregnation with an antidiffusion copper barrier was then studied. The superconducting and mechanical characteristics of these filament bundles were determined. Results show that the method is practicable. A bundle of 3000 carbon filaments was prepared, then coated in niobium carbonitride. However, over any significant length of the obtained line the superconducting characteristics were not constant. The adhesion of the superconducting coating to the filament bundle was also unsatisfactory. Author (ESA)

N80-17383# Thomson-CSF, Boulogne-Billancourt (France). Direc. Tubes Electroniques et Dispositifes a Image.
NUMERICAL TO ANALOG CONVERSION. A HIGH FREQUENCY CONVERTER TUBE Final Report [CONVERSION ANALOGIQUE NUMERIQUE TUBE CONVERTIS SEUR HAUTE FREQUENCE]
Courtan, Deschamps, and Cuchet May 1978 18 p In FRENCH
(TDI/1.032/78) Avail: NTIS HC A02/MF A01

A breadboard model of a high frequency converter tube having opposed electron guns sweeping a silicon diode mosaic target is presented. An input beam energy of 8 keV which allows signals to be registered at a frequency of 150 MHz with a resolution of 400 television lines at the target diameter is examined. The output signal is video and is monitored on a television display. Results indicate that after optimizing the tube/target/tube design it is possible to measure signals at a frequency of 1 GHz. Author (ESA)

N80-17384# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
IMPROVING THE PERFORMANCE OF GaAs INTEGRATED LOGIC CIRCUITS IN ANTICIPATION OF LARGE SCALE INTEGRATION Final Report [AMELIORATION DES PERFORMANCES DES CIRCUITS INTEGRES LOGIQUES AU GaAs EN VUE DE L'INTEGRATION A GRANDE ECHELLE]
Jean Caron, Gilles Durand, and Marc Rocchi May 1979 55 p refs In FRENCH
(Contract DGRST-77-7-0984)
(LEP-79/509.SME-646-h) Avail: NTIS HC A04/MF A01

A computerized simulation of performance and structural parameters for field effect transistors in logic circuits was performed in order to optimize power consumption for diode transistor logic designs. Based on reports from the literature, logic circuits on GaAs generally show an energy dissipation of approximately 20 mW/gate for a limit of 10 gates per integrated circuit. An extensive description of the models used in these simulations is given and, after optimization, best results give a power consumption of 0.05 mW/gate for integrated circuits of from 100 to 1000 gates. Author (ESA)

N80-17385# National Technical Information Service, Springfield, Va.
SQUID DEVICES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Nov. 1979
George W. Reimherr Nov. 1979 125 p Supersedes NTIS/PS-78/1169; NTIS/PS-77/1046; NTIS/PS-76/0872; NTIS/PS-75/687
(PB80-801087; NTIS/PS-78/1169; NTIS/PS-77/1046; NTIS/PS-76/0872; NTIS/PS-75/687) Avail: NTIS HC $30.00/MF $30.00 CSCL 20L

The cited reports of Federally funded research discuss the theory, performance, preparation, and applications of SQUID devices (also called Superconducting Quantum Interference Devices). This updated bibliography contains 119 abstracts, 21 of which are new entries to the previous edition. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N80-17386 Texas Univ. at Arlington.
PREDICTED LARGE EDDIES IN THE FLAT PLATE BOUNDARY LAYER Ph.D. Thesis
Aspi Rustom Wadia 1979 265 p
Avail: Univ. Microfilms Order No. 8001660

An energy extremum principle is used to predict the eigenmodes which correpond to the large eddy structure of the flat plate, fully developed turbulent boundary layer. The results of the theoretical study agree qualitatively with all of Lemmerman's results for small wave numbers and his results are speculated to involve the large scale structure modified by the instabilities of this investigation. The preliminary study of the perturbation velocities indicate that the spanwise fluctuations are extremely large near the wall. The presence of burst and sweep phenomena was identified at the mid section of the boundary layer and it is observed that during the bursting phenomena of boundary layer blow off, the fluid is pushing mostly in the z-direction near the wall to replace the exported fluid. Dissert. Abstr.

N80-17387 George Washington Univ., Washington, D. C.
THERMAL PERFORMANCE OF METAL AND PLASTIC PIPES AS EARTH STORAGE HEAT EXCHANGERS Ph.D. Thesis
Mahmut Nazli 1979 147 p
Avail: Univ. Microfilms Order No. 8001357

Three coil configurations were tested: (1) copper coil in length L, (2) plastic coil of length L, and (3) plastic coil of length 2L. All coils had the same inside and loop diameters. Dry and wet sand were used as storage materials. The storage material was heated by circulating hot water through the coils. In a similar manner, heat was extracted using cold water. The thermal performance of the copper coil of length L and plastic coil of length 2L were very comparable for charging either the dry sand or wet sand storage. In the case of extraction the thermal performance of the copper coil of length L and plastic coil length L were very comparable for the dry sand storage. When the sand was 100 percent saturated with water, the thermal performance of the plastic coil of length 2L and the copper coil of length L were almost the same. Dissert. Abstr.

N80-17388 Cincinnati Univ., Ohio.
CHARACTERISTICS OF THREE-DIMENSIONAL TURBULENT JETS: A NUMERICAL STUDY Ph.D. Thesis
Choudary Ramakrishna Bobba 1979 139 p
Avail: Univ. Microfilms Order No. 8002091

The three-dimensional jet issuing from a rectangular nozzle into a quiescent fluid or a coflowing free stream has been carefully analyzed. The problem is mathematically described by the time-averaged three-dimensional parabolised Navier-Stokes equations in a rectangular coordinate system. The detailed quantitative results obtained for compressible free-shear flows provide further understanding of the structure of the turbulent flows. The discrepancies in the turbulent flow results are attributed to the lack of information on the initial conditions and to the use of a turbulence model based on the assumptions of isotropy and an effective turbulent viscosity. A modified turbulence model which accounts for anisotropy is recommended for similar studies. Dissert. Abstr.

N80-17389 California Univ., Berkeley.
ANALYSIS OF TURBULENT GENERATION BETWEEN HORIZONTAL PLATES Ph.D. Thesis
Massoud Kaviany-Nejad 1979 153 p
Avail: Univ. Microfilms Order No. 8000399

One dimensional analysis of steady state turbulent thermal convection for the case of a fluid layer confined between two horizontal plates is considered. A two-layer model, namely a conduction sublayer and a turbulent-core is adopted. The results for a two-equation model are in fair agreement with the experimental results for turbulent kinetic energy (t.k.e.) production rate of t.k.e. and dissipation-rate of t.k.e. However the numerical results for eddy diffusivities are lower than the experimental results. The results for a one-equation model are also in fair agreement with the experimental results except for eddy diffusivities which are lower than the experimental results. An experiment for transient turbulent thermal convection in a pool of water cooled from above is considered. Dissert. Abstr.

N80-17390 Michigan State Univ., East Lansing.
ARIMA STATISTICAL MODELS OF TRANSIENT HEAT CONDUCTION ERRORS FOR AITKEN'S CONFIDENCE REGION Ph.D. Thesis
Irwin Perry Schisler 1979 201 p
Avail: Univ. Microfilms Order No. 8001587

An iterative Aitken's least squares estimator was implemented within an existing standard least squares computer program for the heat conduction problem. The accuracy of this modified computer code was verified in a simulation study. It was found that the effects of correlated errors for the available dynamic measurements and associated models can be treated without great difficulty. The parameter estimates using standard least squares tend to be very close to the values computed by the more powerful Aitken's least squares method. Hence the parameters required in the covariance matrix, V, can be estimated accurately and easily from the standard least squares residuals. The covariance matrix for the thermal parameters can be evaluated by a simple recursive difference scheme rather than using the covariance matrix V directly in the matrix product. Dissert. Abstr.

N80-17391 California Univ., Berkeley.
DISPERSED FLOW FILM BOILING DURING REFLOODING

Ph.D. Thesis
William Thomas Peake 1979 217 p
Avail: Univ. Microfilms Order No. 8000477

A droplet model was used for the analysis of the fluid flow and heat transfer in the dispersed flow film boiling regime during reflooding of a tubular channel. Comparisons were made of the predicted wall heat fluxes, vapor temperatures, qualities, and droplet diameters and the experimental data. The heat transfer predictions are in agreement with the data at locations away from the quench front for certain values of the initial droplet diameter and velocity. It was observed that the initial droplet diameter, and to lesser extent the initial droplet velocity, had a large effect upon the predicted wall heat flux. Calculations were made for initial droplet sizes varying between 0.5 and 2.0 mm. Dissert. Abstr.

N80-17392 Rutgers - The State Univ., New Brunswick, N. J.
DOUBLE-DIFFUSIVE CONVECTIVE INSTABILITY OF AN INCLINED FLUID LAYER Ph.D. Thesis
Ramesh Chandra Paliwal 1979 132 p
Avail: Univ. Microfilms Order No. 7928434

A total of 21 experimental runs - at least two at each inclination of the fluid layer from the vertical - is reported. A finite difference scheme as well as the Galerkin method are developed to solve the stability equations. In view of the computational efficiency and economy, final computations are made using the Galerkin technique with 12 terms in the truncated expansion series. For -75 deg < theta < 75 deg, critical instability is found to be of stationary type. Theoretically calculated results of the critical thermal Rayleigh numbers and the critical wave numbers at various inclinations are in very good agreement with the experimental data. Dissert. Abstr.

N80-17393 California Univ., Berkeley.
EXPERIMENTAL AND NUMERICAL INVESTIGATION OF NATURAL CONVECTION IN CYLINDRICAL ENCLOSURES Ph.D. Thesis
Cecil Fernando HessSilva 1979 171 p
Avail: Univ. Microfilms Order No. 8000377

Axisymmetric natural convection flows in an enclosure are studied experimentally and analytically. Two boundary conditions were studied experimentally: (1) a constant heat flux (CHF) on the side walls; and (2) a constant temperature source (CTS) on the top of the side walls. It was observed in the CHF experiments that a quasi-steady regime was achieved after extended periods of time. Expressions for the velocity and temperature profiles are presented for various boundary conditions. Correlations of the Nusselt number for various Rayleigh numbers and wall materials are presented for the CTS boundary condition. Results computed with this method are in good agreement with the numerical solution and experimental data. Dissert. Abstr.

N80-17394 Ohio State Univ., Columbus.
FULLY IMPLICIT SOLUTION OF THE NAVIER-STOKES EQUATIONS AND ITS APPLICATION TO NON-RECTANGULAR GEOMETRY BY THE USE OF ORTHOGONAL MESH GENERATION Ph.D. Thesis
Robert Gerald Govenar 1979 290 p
Avail: Univ. Microfilms Order No. 8001735

A numerical method of solution for the Navier-Stokes equations is developed for non-rectangular geometries. A fully implicit technique is developed making use of a fast direct solution method. A technique for generating an orthogonal curvilinear mesh is developed by utilizing a non-orthogonal curvilinear mesh and solution of two Laplace equations, followed by interpolation. The results of these studies are combined and applied to a non-rectangular geometry. Dissert. Abstr.

N80-17395 California Univ., Berkeley.
EXPERIMENTAL STUDY OF UNSTEADY ENTRANCE FLOW IN A CURVED PIPE Ph.D. Thesis
Karl Ow Gong 1979 157 p
Avail: Univ. Microfilms Order No. 8000356

The effect of pulsatility of the entry flow within a curved pipe was investigated experimentally. The curved pipes used in the experiments were of circular cross section and 180 deg bend. The pulsatile flows in the experiments conformed to the flow rate equation Q = Q sub DC + Q sub AC(cos(omega)(t)-psi. A laser Doppler anemometer system with a rotating diffraction grating used as a frequency shifting device was used to obtain the axial and secondary velocities. The three parameters describing unsteady flows in a curved pipe were the mean alternative Dean number, the frequency parameter, and the amplitude ratio. The first experiment was performed on the curved pipe with a curvature to radius ratio L/a = 20, and with parametric values kappa = 120, alpha = 8.0 and gamma = .34. Significant observations and results of all three experiments are given. Dissert. Abstr.

N80-17396*# Cambridge Hydrodynamics, Inc., Mass.
ADVANCED STABILITY THEORY ANALYSES FOR LAMINAR FLOW CONTROL Final Report
Steven A. Orszag Feb. 1980 50 p refs
(Contract NAS1-15372)
(NASA-CR-3233) Avail: NTIS HC A03/MF A01 CSCL 20D

Recent developments of the SALLY computer code for stability analysis of laminar flow control wings are summarized. Extensions of SALLY to study three dimensional compressible flows, nonparallel and nonlinear effects are discussed. Author

N80-17397*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF A CERAMIC COATING ON METAL TEMPERATURES OF AN AIR-COOLED TURBINE VANE
Herbert J. Gladden and Curt H. Liebert Feb. 1980 29 p refs
(NASA-TP-1598; E-167) Avail: NTIS HC A03/MF A01 CSCL 20D

The metal temperatures of air cooled turbine vanes both uncoated and coated with the NASA thermal barrier system were studied experimentally. Current and advanced gas turbine engine conditions were simulated at reduced temperatures and pressures. Airfoil metal temperatures were significantly reduced, both locally and on the average, by use of the the coating. However, at low gas Reynolds number, the ceramic coating tripped a laminar boundary layer on the suction surface, and the resulting higher heat flux increased the metal temperatures. Simulated coating loss was also investigated and shown to increase local metal temperatures. However, the metal temperatures in the leading edge region remained below those of the uncoated vane tested at similar conditions. Metal temperatures in the trailing edge region exceeded those of the uncoated vane. K.L.

N80-17398*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VOLUME-ENERGY PARAMETERS AND TURBULENT-FLOW DENSITY FLUCTUATIONS
Robert C. Hendricks Jan. 1980 28 p refs
(NASA-TP-1585; E-127) Avail: NTIS HC A03/MF A01 CSCL 20D

Volume-energy relations determined from an equation of state were used to group many sets of heat transfer data for liquids and gases, including the near-critical region. The volume - Gibbs energy parameter grouped these data better than did such other parameters as enthalpy, temperature, or internal energy. K.L.

N80-17399*# Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology.
A LASER TOMOGRAPHIC INVESTIGATION OF LIQUID FUEL SPRAYS
A. J. Yule, C. AhSeng, P. Felton, A. Ungut, and N. A. Chigier [1980] 25 p refs Sponsored in part by AFOSR, U.S. Navy and U.S. Army
(Grant NsG-7517)
(NASA-CR-162765) Avail: NTIS HC A02/MF A01 CSCL 20D

A light scattering technique is combined with a tomographic transformation to convert line of sight integrated data, measured in sprays, to measurements of droplet size and concentration in volume elements within the spray. The technique is developed and assessed by systematic experiments in axisymmetric sprays generated by twin-fluid atomisers. The good agreement found shows that, provided certain conditions are satisfied by the local spray structure, the technique provides information on spray structure, similar in detail and extent to that derived by photography, but with reduced experimental time. The technique is applied to an investigation of a kerosene spray vaporizing in a hot gas stream. M.M.M.

N80-17400*# National Aeronautics and Space Administration, Washington, D. C.

FIRST RESULTS OF A STUDY ON TURBULENT BOUNDARY LAYERS IN OSCILLATING FLOW WITH A MEAN ADVERSE PRESSURE GRADIENT

R. Houdeville and J. Cousteix Nov. 1979 37 p refs Transl. into English of conf. paper "Premiers Resultants d'une Etude sur les Couches Limites Turbulents en Ecoulement Pulse avec Gradient de Pression Moyen Defavorable" p 1-16 Presented at the 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978 Original language document announced as A79-35110 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(NASA-TM-75799) Avail: NTIS HC A03/MF A01 CSCL 20D

The development of a turbulent unsteady boundary layer with a mean pressure gradient strong enough to induce separation, in order to complete the extend results obtained for the flat plate configuration is presented. The longitudinal component of the velocity is measured using constant temperature hot wire anemometer. The region where negative velocities exist is investigated with a laser Doppler velocimeter system with BRAGG cells. The boundary layer responds by forced pulsation to the perturbation of potential flow. The unsteady effects observed are very important. The average location of the zero skin friction point moves periodically at the perturbation frequency. Average velocity profiles from different instants in the cycle are compared. The existence of a logarithmic region enables a simple calculation of the maximum phase shift of the velocity in the boundary layer. An attempt of calculation by an integral method of boundary layer development is presented, up to the point where reverse flow starts appearing. M.M.M.

N80-17401# Naval Postgraduate School, Monterey, Calif.

MEASUREMENTS OF JET DISPERSIONS SIMULATED IN AN AERONAUTICAL WIND TUNNEL M.S. Thesis

J. V. Brendmoen Sep. 1979 94 p refs
(AD-A076578) Avail: NTIS HC A05/MF A01 CSCL 13/2

A neutrally stable atmospheric surface layer was suitably simulated in a low speed wind tunnel by tripping the boundary layer with a fence and letting the turbulent flow develop over a length of roughness elements. Jet exhaust dispersion characteristics, simulated by a burner/nozzle system, were investigated by measuring the horizontal and vertical temperature profiles at axial stations downwind from the nozzle exit. Dispersion sensitivity to different nozzle exit conditions, angles of incidence to the wind, the nozzle surface blockage were investigated. The results were compared to disperison methods used in the Air Quality Assessment Model (AQAM). It was found that the experimental jet penetration length was much shorter than that assumed in AQAM, and that a plume rise existed, which is not included in the current AQAM model. Required inputs of the initial dispersion coefficients were determined as a function of wind direction. GRA

N80-17402# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

NUMERICAL FLOW FIELD PROGRAM FOR AERODYNAMIC HEATING ANALYSIS Interim Technical Report, Jun. 1977 - Dec. 1978

H. J. Fivel Wright-Patterson AFB, Ohio AFFDL Apr. 1979 157 p refs
(Contract F33615-77-C-3003; AF Proj. 2404)
(AD-A076442; AFFDL-TR-79-3025) Avail: NTIS HC A08/MF A01 CSCL 20/4

This report documents the first phase of a study to modify an existing computer program which provides an economical and easy to use analytic tool for aerodynamic heating to a wide variety of 3-dimensional vehicle configurations. This report also serves as a preliminary version of a user's manual for the computer program plus two auxiliary programs written to analyze vehicle geometry, and presents program capabilities, input/output characteristics, and example problems. Core requirements have been minimized by the use of overlays. User oriented features of the program include minimized input requirements and various options for application flexibility. GRA

N80-17403# National Technical Information Service, Springfield, Va.

SHEAR FLOW. PART 2: BASES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - Oct. 1979

Guy E. Habercom, Jr. Nov. 1979 311 p Supersedes NTIS/PS-78/1161; NTIS/PS-77/1038; NTIS/PS-76/0936; NTIS/PS-75/821
(PB80-800394; NTIS/PS-78/1161; NTIS/PS-77/1038; NTIS/PS-76/0936; NTIS/PS-75/821) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D

In this bibliography, reports on shear flow in gases including air, exhausts, lasers, and plasmas are cited. Characteristics are discussed involving boundary layer dynamics, shock waves, turbulent flow and mixing; stratification, wake, wind tunnel testing, subsonic, transonic, supersonic, and hypersonic flow, geometric configurations, magnus force, turbine blades, airfoils, and airframes, and magnetohydrodynamics. Some reference is made to flow separation and reattachment, the subjects also of other bibliographies. Model tests, jets channel flow, and additional topics are discussed. This updated bibliography contains 303 abstracts, 32 of which are new entries to the previous edition. GRA

N80-17404# National Technical Information Service, Springfield, Va.

SHEAR FLOW. PART 3: GENERAL STUDIES. A BIBLIOGRAPHY WITH ABSTRACTS

Guy E. Habercom, Jr. Nov. 1979 293 p
(PB80-800402; NTIS/PS-78/1162) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D

General aspects of fluid shear in laminar and turbulent flow are discussed. The discussions cover boundary layer dynamics, layers, stratified flow, stresses, ducts, pipes, channels, mixing, bursts, magnetohydrodynamics, viscosity, and oscillation. References are made to separation and reattachment. Wind tunnel modeling and flat plate characteristics are described, including mathematical models, computerized simulation, theory, equations of motion, anemometry, numerical analysis, and stability. Data are given on wall flow, wake, heat transfer, and pressure gradients. Wind shear is excluded. This updated bibliography contains 285 abstracts, 20 of which are new entries to the previous edition. GRA

N80-17405# ARO, Inc., Arnold Air Force Station, Tenn.

SEPARATED AND NONSEPARATED TURBULENT FLOWS ABOUT AXISYMMETRIC NOZZLE AFTERBODIES. PART 2: DETAILED FLOW MEASUREMENTS Final Report, 1 Oct. 1977 - 1 Dec. 1978

John A. Benek AEDC Oct. 1979 215 p refs Sponsored by the Air Force
(AD-A076458; AEDC-TR-79-22) Avail: NTIS HC A10/MF A01 CSCL 20/4

Measurements of mean velocity, specific turbulent kinetic energy, and specific Reynolds shear were obtained at M to the base infinity – 0.64 and ReD – 288,600 in a symmetry plane of two axisymmetric, circular-arc, boattail geometries each of which had a solid plume simulator. The geometries were selected such that an attached- and a separated flow boundary layer would be obtained. Ancillary measurements, consisting of model surface and tunnel wall, axial, static pressure distributions, and velocity vectors near the tunnel wall provide a well-defined domain with which to validate numerical flow simulations. Tabulations of the data and coefficients of least-squares dubic spline fits to the data are presented. GRA

N80-17406# Binary Systems, Inc., Silver Spring, Md.

WAVENUMBER SPECTRAL MEASUREMENT OF TURBULENT BOUNDARY LAYER WALL PRESSURE BY MAXIMUM LIKELIHOOD METHODS Final Report

P. S. Tong Apr. 1979 44 p refs
(Contract N00014-72-C-0318)
(AD-A076499; WBR-79-2) Avail: NTIS HC A03/MF A01 CSCL 20/4

A combined procedure based on conventional and maximum likelihood spectral estimation techniques is proposed for the measurement of turbulent boundary layer pressure fluctuation wavenumber spectrum. It is shown that the mixed procedure is more tolerant to sensor inaccuracies in amplitude, phase or phase center alignment. GRA

N80-17407# Johns Hopkins Univ., Baltimore, Md. Dept. of Earth and Planetary Sciences.

A NEW THEORY OF TURBULENT FLOW IN A PIPE

Robert R. Long Sep. 1979 58 p refs Sponsored in part by the NSF, Washington, D.C.
(Contract N00014-75-C-0805; Grant NSF OCE-76-18887; Grant NSF ATM-76-22284)
(AD-A076598; TR-16-SER-C) Avail: NTIS HC A04/MF A01 CSCL 20/4

A new theory of turbulent shear flow is based on the discovery of a second boundary layer, which we call the viscous mesolayer. The existence of this layer between the core and the sublayer makes it impossible to match the outer (core) expressions for mean quantities with the inner expressions based on Prandtl's 'law of the wall', as in classical theory. Indeed, the supposed region of applicability of the classical theory, namely the layer in which both inner and outer behaviors are imposed, is precisely in the mesolayer where either behavior may be imposed. The mesolayer concept is used to develop a new theory of the distribution of mean quantities in pipe flow. Solutions are obtained for the mean quantities in an inertial sub-range and in a viscous subrange on either side of the mesolayer. Major alterations in the classical theory results. GRA

N80-17408# Wisconsin Univ. - Madison. Mathematics Research Center.

THE INITIAL VALUE PROBLEM FOR THE EQUATIONS OF MOTION OF COMPRESSIBLE VISCOUS AND HEAT-CONDUCTIVE FLUIDS

Akitaka Matsumura and Takaaki Nishida Sep. 1979 14 p ref
(Contract DAAG29-75-C-0024)
(AD-A077136; MRC-TSR-1991) Avail: NTIS HC A02/MF A01 CSCL 20/4

The initial value problem associated with the equations of motion for isotropic Newtonian fluids is investigated. The fluids are compressible, viscous and heat-conductive. It is proved that there exists a unique global solution in time, for the small initial data, and the solution has the decay rate of (1 - t) to 3/4 power as t approaches positive infinity. The motions of compressible, viscous and heat-conductive fluids are described by a system of partial differential equations which is of hyperbolic-parabolic type and highly nonlinear. One of the first mathematical problems associated with this system is the initial value problem. We obtain the existence of a unique smooth global solution in time for the initial value problem and also the decay rate of the solution as time tends to infinity. GRA

N80-17409# Wisconsin Univ. - Madison. Mathematics Research Center.

ON THE SWIRLING FLOW BETWEEN ROTATING COAXIAL DISKS, ASYMPTOTIC BEHAVIOR 2

Heinz Otto Kreiss (California Inst. of Tech., Pasadena) and Seymour V. Parter Jul. 1979 44 p refs
(Contracts DAAG29-75-C-0024; N00014-76-C-0341)
(AD-A077126; MRC-TSR-1981) Avail: NTIS HC A03/MF A01 CSCL 20/4

Solutions of the von Karman equations for the swirling flow between two rotation coaxial disks are discussed. The shapes and asymptotic behavior are considered along with the types of permissible limit functions. The cell structure is studied in detail for the case when the limit function oscillates about zero. F.O.S.

N80-17410# Argonne National Lab., Ill. Reactor Analysis and Safety Div.

FINITE ELEMENT FORMATION FOR FLUID-STRUCTURE INTERACTION IN THREE-DIMENSIONAL SPACE

R. F. Kulak 1979 32 p refs Presented at the 3d US Natl. Congr. on Pressure Vessels and Piping, San Francisco, 25 Jun. 1979
(Contract W-31-109-eng-38)
(CONF-790615-26) Avail: NTIS HC A03/MF A01

A development is presented for a three-dimension hexahedral hydrodynamic finite-element. Using trilinear shape functions and assuming a constant pressure field in each element, simple relations were obtained for internal nodal forces. Because the formulation was based upon a rate approach it was applicable to problems involving large displacements. This element was incoporated into an existing plate-shell finite element code. Diagonal mass matrices were used and the resulting discrete equations of motion were solved using explicit temporal integrator. Results for several problems are presented which compare numerical predictions to closed form analytical solutions. In addition, the fluid-structure interaction problem of a fluid-filled, cylindrical vessel containing internal cylinders was studied. DOE

N80-17411# Universite des Sciences et Techniques de Lille (France).

AN APPLICATION OF THE NUMERICAL SOLUTION OF NONLINEAR PROBLEMS IN FLUID MECHANICS USING LEAST SQUARES AND FINITE ELEMENT METHODS, TO UNSTEADY NAVIER-STOKES EQUATIONS [UNE APPLICATION DE LA SOLUTION NUMERIQUE DE PROBLEMS NONLINEARES EN MECHANIQUE DES FLUIDES]

B. Mantel, J. Periaux, and P. Perrier Paris Assoc. Aeron. et Astronautique de France 1979 35 p refs In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-06; ISBN-2-7170-0539-0) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 29 (France and EEC) FF 33 (others)

A calculation method for viscous fluid flow at mid-range Reynolds numbers is presented. Application to the formulation of a computer program for the numerical simulation of separated turbulent flow at large Reynolds numbers, adding to the Navier-Stokes equations either a classic turbulence model or a homogenized random turbulence expression, is shown. The use of optimal control theory with a distributed parameter system to adjust the parameters so as to assure convergence of the algorithm and to permit the use of smaller computers is also proposed. As for the treatment of nonlinearities, gradient conjugates which have been conditioned to be unconditionally stable in time are suggested. Author (ESA)

N80-17412# Institut de Mecanique des Fluides de Marseille (France).

TRANSITION OF AN OSCILLATING INCOMPRESSIBLE FLOW IN A PIPE OR IN A BOUNDARY LAYER [TRANSITION D'UN ECOULEMENT OSCILLATOIRE INCOMPRESSIBLE DANS UNE CONDUITE OU DANS UNE COUCHE LIMITE]

J. Fauchas and C. Clarion Paris Assoc. Aeron. et Astronautique de France 1979 20 p refs In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-09; ISBN-2-7170-0536-6) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 17 (France and EEC) FF 21 (others)

A mathematical description of a parallel, or quasi-parallel, incompressible unsteady flow is given as the starting point for a prediction of the transistion from laminar to turbulent flow using an energy method. A critical value is determined for the analytic expression of the velocity field as a function of space-time coordinates. Similitude parameters are considered. Calculations are shown to be in good agreement with reported experimental results where it has been observed the beginning of the transition corresponds with the development of point instabilities in the laminar flow regime of a pulsating sinusoidal flow in a cylindrical horizontal tube. Author (ESA)

N80-17413# Aix-Marseilles Univ. (France). Inst. de Mecanique Statistique de la Turbulence.

VISUALIZATION OF UNSTEADY STRUCTURES IN A TURBULENT FLOW DOWNSTREAM FROM ONE AND FROM TWO PARALLEL BARS [VISUALISATION DES STRUCTURES INSTATIONNAIRES DANS UN ECOULEMENT TURBULENT, EN AVAL D'UN ET DE DEUX BARREAUX PARALLELES]

C. Domptail, P. Bonmarin, and R. Dumas Paris Assoc. Aeron. et Astronautique de France 1979 22 p refs In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseilles, 7-9 Nov. 1978
(AAAF-NT-79-14; ISBN-2-7170-0541-2) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 12 (France and EEC) FF 21 (others)

The design of a hydrodynamic tunnel with a vertical axis for flow visualization, using a lasar Doppler velocimeter, is presented. This apparatus was used to study the turbulent flow downstream from a single cylindrical bar, then to study the wake downstream from two parallel bars of equal diameter, and finally of two parallel bars of different diameters. Flow visualization results are given which show, notably, the development of counter gradient diffusion phenomena in the wake of the two bars of different diameters. An interpretation is given based on the hypothesis which links this phenomenon to an asymmetry in the rotation of large pseudo-coherent vortices. Author (ESA)

N80-17414# Technische Hochschule, Aachen (West Germany). Inst. fuer Luft u. Raumfahrt.
DETERMINATION OF THE PRESSURE FIELD AROUND A SLENDER BODY ACCELERATING AT A SMALL ANGLE OF ATTACK, USING A MOVING SINGULARITIES METHOD [BESTIMMUNG DER DRUCKPUNKTLAGE BEI SWACH ANGESTELLTEN, BESCHLEUNIGTEN DREHKOERPERN MIT HILFE DER METHODE DER BEWEGTEN SINGULARITAETEN]
W. Arrenbrecht, A. Beyer, and J. Ballman Bonn Dokzentbw Apr. 1979 69 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(Contract T/RF-41/70040/71439)
(BMVG-FBWT-79-8) Avail: NTIS HC A04/MF A01; Dokzentbw, DM 30

A singularity method for the calculation of the potential flow around a slender body of revolution accelerating in a compressible fluid at small angle of attack is presented. Two different types of moving singularities are used and their derivation is shown. The time dependence of the solutions is characterized either by the dirac delta function (solitary disturbance) or by a heavyside function (continuous disturbance starting at time tau). Author (ESA)

N80-17415# Admiralty Marine Technology Establishment, Teddington (England).
THE EFFECT OF A PROPULSOR ON THE HULL BOUNDARY LAYER OF A BODY OF REVOLUTION
D. J. Atkins London HMSO May 1979 18 p refs
(AMTE-N-TM79101; BR68408) HC A02/MF A01

An axisymmetric boundary layer prediction method modified to include an approximate representation of a lightly loaded propulsor is discussed. The method is capable of predicting the effect of single and contra-rotating propellers on the boundary layer flow in the vicinity of the propulsor. Author (ESA)

N80-17416# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
BOUNDARY LAYERS IN AN OSCILLATING FLOW
Jean Cousteix 1979 35 p refs In FRENCH; ENGLISH summary
(ONERA-NT-1979-1) Avail: NTIS HC A03/MF A01

Unsteady flows which are periodic on the average with the external velocity oscillating around a zero or nonzero mean time value are considered. A review of related theoretical and experimental work is presented with emphasis on the boundary layers associated with this type of flow. Numerical methods for calculating these boundary layers are outlined and compared. Their validity relative to recent experimental results is evaluated. Author (ESA)

N80-17417# National Technical Information Service, Springfield, Va.
BOUNDARY LAYER CONTROL, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1975 - Oct. 1979
Guy E. Habercom, Jr. Nov. 1979 273 p Supersedes NTIS/PS-78/1150; NTIS/PS-77/0989; NTIS/PS-76/0928; NTIS/PS-75/824
(PB80-800337; NTIS/PS-78/1150; NTIS/PS-77/0989; NTIS/PS-76/0928; NTIS/PS-75/824) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D

Citations of applications to aerodynamics, hydrodynamics, turbomachinery and liquid flow are presented. Discussions refer to components and configurations. Flow fields include subsonic, transonic, supersonic, and hypersonic. Analyses involve computerized simulations, mathematical models and methods, and numerical solutions. Additional topics are temperature effects, mechanical responses, unsteady dynamics, and heat and mass transfer. This updated bibliography contains 265 abstracts, 51 of which are new entries to the previous edition. GRA

N80-17418# National Technical Information Service, Springfield, Va.
FLOW REATTACHMENT. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Oct. 1979
Guy E. Habercom, Jr. Nov. 1979 128 p Supersedes NTIS/PS-78/1158; NTIS/PS-77/0988; NTIS/PS-76/0925
(PB80-800345; NTIS/PS-78/1158; NTIS/PS-77/0988; NTIS/PS-76/0925) Avail: NTIS HC $30.00/MF $30.00

Studies are reported on certain fluid flow conditions where, after boundary layer or flow separation has occurred, the flow attaches again to a surface. The materials cover both laminar and turbulent boundary layers in gases and liquids, principally the former. Aerodynamic and gas flow research relates to subsonic, transonic, supersonic, and hypersonic speeds involving plane, curved, and cavity surfaces for various types of flow. Applications are to such forms as geometric shapes, ramps, wings, airfoils, and other bodies. Wind tunnel testing is described. Hydrodynamic and liquid flow data refer to jets and fluidic devices. Mathematical models and analyses are included. This updated bibliography contains 123 abstracts, 3 of which are new entries to the previous edition. GRA

N80-17419# National Technical Information Service, Springfield, Va.
SHEAR FLOW, PART 1: LIQUIDS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Oct. 1979
Guy E. Habercom, Jr. Nov. 1979 218 p Supersedes NTIS/PS-78/1160; NTIS/PS-77/1037; NTIS/PS-76/0935; NTIS/PS-75/819
(PB80-800386; NTIS/PS-78/1160; NTIS/PS-77/1037; NTIS/PS-76/0935; NTIS/PS-75/819) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D

Shear flow and stresses are studied for a number of liquid forms such as water, lubricants, polymers, liquified gases, and liquid metals. The studies relate to hydrodynamics, elastohydrodynamics, magnetohydrodynamics, fluerics, rheology, acoustics, and oceanology. Some of the subjects include cavitation, jets, mixing, stratification, ultrasonics, capillary flow, blood circulation, sedimentation, wake, injection, liquid-gas interactions, and pipe and channel flow. Other topics cover drops, surface flow, nonnewtonian fluids, liquid crystals, hydraulic fluids, and layers. Theoretical aspects, mathematical models, equations of motion, computer programs, measurement technology, and empirical relationships are included. This updated bibliography contains 210 abstracts, 8 of which are new entries to the previous edition. GRA

N80-17296*# Naval Surface Weapons Center, White Oak, Md.
A NUMERICAL COMPARISON WITH AN EXACT SOLUTION FOR THE TRANSIENT RESPONSE OF A CYLINDER IMMERSED IN A FLUID
M. E. Giltrud and D. S. Lucas *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 23-28 refs (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 20D

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-17420# National Research Council of Canada, Ottawa (Ontario).
VELOCITY MEASUREMENT BY THE CORRELATION METHOD; ACCURATE, CONTACTLESS, NO MOVING PARTS

Ingvar Andermo, Goran Moerkoch, and Anders Sjoelund 1980 15 p
(NRC/CNR-TT-1958; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

Velocity measurements by the correlation method were assessed and found to be accurate measures. The wide range of applications of the correlation method are discussed. R.E.S.

N80-17421*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MULTI-CHANNEL TEMPERATURE MEASUREMENT AMPLIFICATION SYSTEM Patent Application
James R. Currie, inventor (to NASA) Filed 29 Nov. 1979 19 p
(NASA-Case-MFS-23775-1; US-Patent-Appl-SN-098569) Avail: NTIS HC A02/MF A01 CSCL 14B

A multichannel temperature amplification system for solar energy applications is presented. Differential thermocouple outputs are sequentially amplified by a common amplifier and compared with a reference temperature signal in an offset correction amplifier. A poled output signal is provided when a differential output is of a discrete level. NASA

N80-17422*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FATIGUE STRENGTH TESTING EMPLOYED FOR EVALUATION AND ACCEPTANCE OF JET-ENGINE INSTRUMENTATION PROBES
Everett C. Armentrout 1980 25 p refs Presented at 25th Ann. Intern. Gas Turbine Conf., New Orleans, 9-13 Mar. 1980; sponsored by ASME
(NASA-TM-81402; E-313) Avail: NTIS HC A02/MF A01 CSCL 14B

The fatigue type testing performed on instrumentation rakes and probes intended for use in the air flow passages of jet engines during full scale engine tests is outlined. A discussion of each type of test performed, the results that may be derived and means of inspection is included. R.E.S.

N80-17423*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTICAL SENSORS FOR AERONAUTICS AND SPACE
R. J. Baumbick, J. Alexander (NASA. Johnson Space Center), R. Katz (Naval Avionics Center, Indianapolis, Ind.), and J. Terry (Army Applied Technology Labs., Ft. Eustis, Va.) Jan. 1980 16 p
(NASA-TM-81407; E-321) Avail: NTIS HC A02/MF A01 CSCL 14B

A review of some NASA and DOD programs to develop optical sensors with fiberoptics for instrumentation and control is presented. Fiberoptic systems offer some distinct advantages. Noise immunity is one important asset. Fiberoptic systems do not conduct electricity and therefore can be used in and near areas that contain explosive or flammable materials. One objective of these programs is to produce more reliable sensors and to improve the safety and operating economy of future aircraft and space vehicles. Author

N80-17424*# Oklahoma Univ., Norman.
MINIATURE PIEZORESISTIVE SOLID STATE INTEGRATED PRESSURE SENSORS Final Report
Seun K. Kahng Feb. 1980 32 p refs
(Grant NsG-1481)
(NASA-CR-162752) Avail: NTIS HC A03/MF A01 CSCL 14B

The characteristics of silicon pressure sensors with an ultra-small diaphragm are described. The pressure sensors utilize rectangular diaphragm as small as 0.0127 x 0.0254 cm and a p-type Wheatstone bridge consisting of diffused piezoresistive elements, 0.000254 cm by 0.00254 cm. These sensors exhibit as high as 0.5 MHz natural frequency and 1 mV/V/psi pressure sensitivity. Fabrication techniques and high frequency results from shock tube testing and low frequency comparison with microphones are presented. Author

N80-17425*# Pratt and Whitney Aircraft, East Hartford, Conn.
THIN FILM TEMPERATURE SENSOR
H. P. Grant and J. S. Przybyszewski 15 Feb. 1980 61 p refs
(Contract NAS3-20768)
(NASA-CR-159782; PWA-5526-31) Avail: NTIS HC A04/MF A01 CSCL 14B

Thin film surface temperature sensors were developed. The sensors were made of platinum-platinum/10 percent rhodium thermocouples with associated thin film-to-lead wire connections and sputtered on aluminum oxide coated simulated turbine blades for testing. Tests included exposure to vibration, low velocity hydrocarbon hot gas flow to 1250 K, and furnace calibrations. Thermal electromotive force was typically two percent below standard type S thermocouples. Mean time to failure was 42 hours at a hot gas flow temperature of 1250 K and an average of 15 cycles to room temperature. Failures were mainly due to separation of the platinum thin film from the aluminum oxide surface. Several techniques to improve the adhesion of the platinum are discussed. R.E.S.

N80-17426# Texas Technological Univ., Lubbock. Optical Systems Lab.
MULTIPLEX HOLOGRAPHY FOR SPACE-VARIANT OPTICAL PROCESSING, PARTS 1 AND 2
Mike I. Jones and E. Lee Kral 1 Sep. 1979 320 p refs
(Grant AF-AFOSR-2855-75)
(AD-A074987; AFOSR-79-0991TR) Avail: NTIS HC A14/MF A01 CSCL 20/6

A major goal of the research effort has been the implementation of two-dimensional representations of space-variant optical systems. In a sampling theorem-based approach this requires sampling the system's input plane and multiplexing the system's transfer functions for the various input plane samples. Our technique utilizes diffusers in the individual reference beams to encode the sequentially-recorded holograms so as to minimize hologram-to-hologram crosstalk on playback. Part 1 of this report presents the results of a detailed examination of the use of ground glass diffusers with up to 100 holograms being multiplexed. Experimental results include the representation of a strongly space-variant magnifier, and a demonstration that indeed the individually multiplexed holograms are adding coherently on playback. Part 2 contains properties of various models of pure phase, pure amplitude, and combined amplitude, and combined amplitude and phase diffusers. A spatial random telegraph wave description is employed for the diffusers, with either evenly spaced transition points or Poisson distributed transitions assumed. GRA

N80-17427# Army Engineer Topographic Labs., Fort Belvoir, Va.
MATERIALS RESEARCH FOR HOLOGRAPHIC RECORDING. NUMBER 3: HARDENED GELATIN HOLOGRAPHIC RECORDING MATERIALS
James W. Gladden and John W. Eastes Sep. 1979 69 p refs
(DA Proj. 4A1-61102-B-52C)
(AD-A076203; ETL-0197; Rept-3) Avail: NTIS HC A04/MF A01 CSCL 14/5

The results of a study of four different hardened gelatin holographic recording materials are reported. These are the dichromated, diazo, diazo resin, and silver halide (sensitized) gelatins. The report concludes that of the four photosensitive processes studied, the silver halide (sensitized) gelatin process offers the most promising process characteristics. The silver halide gelatin process is a new holographic recording process that can be used to prepare phase volume holograms in hardened gelatin. The process uses a reversal bleach that dissolves the developed silver metal image while further crosslinking the gelatin in the vicinity of the silver image. Upon fixing and with dehydration of the resulting gelatin hologram, one obtains recordings similar to those produced by the dichromated gelatin process. This is accomplished with exposures on the order of 200 to 500 micron J/sq cm at 514.5 nm in a silver halide emulsion that has a panchromatic response. Furthermore, because the hologram has no silver halide present, the hologram does not exhibit the printout phenomena characteristic of bleached holograms. GRA

N80-17428# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
RESPONSE OF SLIGHTLY DAMPED GYROSCOPIC SYSTEMS

L. Meirovitch and G. Ryland, II 1979 41 p refs
(Contract N00014-78-C-0194)
(AD-A075283) Avail: NTIS HC A03/MF A01 CSCL 17/7

A second-order perturbation theory is developed for the response of slightly damped gyroscopic systems. The solution is based on the Eigensolution for undamped gyroscopic systems and is expressed in terms of real quantities alone. GRA

N80-17429# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
HIGH-G GIMBAL TECHNOLOGY STUDIES
A. Rodgers Jul. 1979 25 p refs
(AD-A076488; DRSMI-T-79-75) Avail: NTIS HC A02/MF A01 CSCL 17/7

The objective of this task is to study the gimbal technology and predict feasible concepts worthy of demonstrating a two-axes wide angle stabilized gimbal system. Acceleration environments for the high velocity projectiles are of such intensities that special bearing protection design technology is required to develop a cannon type launchable gimbal system. GRA

N80-17430# Army Engineer Topographic Labs., Fort Belvoir, Va.
FOURIER TRANSFORM AUTOCORRELATION
Michael M. McDonnell Apr. 1979 37 p
(DA Proj. 4A1-61101-A-91D)
(AD-A076109; ETL-0184) Avail: NTIS HC A03/MF A01 CSCL 14/5

This report describes a device which can take a complete Fourier transform of the intensity transmittance of a photographic transparency. The transform is taken by purely optical means. A complete system analysis is presented, and some results of experiments with the device are described. GRA

N80-17431# Pennsylvania State Univ., University Park. Applied Research Lab.
THE DESIGN OF PIEZOELECTRIC TRANSDUCERS USING GOAL PROGRAMMING M.S. Thesis
Diana F. McCammon 11 Jun. 1979 97 p refs
(Contract N00024-79-C-6043)
(AD-A075282; ARL/PSU/TM-79-140) Avail: NTIS HC A05/MF A01 CSCL 09/5

The design of piezoelectric transducers often involves the satisfaction of multiple, conflicting design specifications. The use of conventional mathematical programming techniques in this endeavor has been inhibited by their inability to consider these multiple objectives within their design formulations. Goal programming is an effective alternative methodology. Transducer design analysis through goal programming provides the optimal solution to the multiple criteria of various types of transducers. The solutions to five design specifications for a reasonably complex transducer are presented. The details of the formulation and analysis of results provide an indication of the ability of this approach to resolve even more complex transducer design problems. GRA

N80-17432# Abcor, Inc., Wilmington, Mass. Walden Div.
RESEARCH ON PERSONAL DOSIMETERS TO MEASURE HYDRAZINE FUELS IN AIR Final Report, Aug. 1977 - Dec. 1978
Rosemary Ellersick Oct. 1979 61 p
(Contract F33615-77-C-0618; AF Proj. 7930)
(AD-A077034; SAM-TR-79-22) Avail: NTIS HC A04/MF A01 CSCL 06/18

The wide use of toxic and highly reactive hydrazine and unsymmetrical dimethylhydrazine (UDMH) as rocket motor fuels created a need to monitor their vapors in air at concentrations as low as 0.1 ppm. The objective of this research effort was to develop, test, and deliver prototype models of a hydrazine fuels dosimeter capable of filling the personal-exposure monitoring part of this need. This report describes the building and testing of a hydrazine dosimeter. Significant analytical difficulties were encountered. The most precise hydrazine measurements were made using the para-dimethylaminobenzaldehyde (PDAB) colorimetric analysis; isothermal furaldehyde GC analysis was satisfactory but less precise. UDMH analysis was much more difficult. A tedious adaptation of the TPF colorimetric analysis gave reasonable results, but the temperature-programmed furaldehyde GC analysis was not satisfactory. UDMH analysis/collection was not fully evaluated because of program duration and budget considerations; hydrazine evaluation was extensive. Laboratory test exposures to low ppm concentrations of hydrazine and UDMH were done with the linearity of the dosimeter's response to 0.1-10-ppm time-weighted average concentrations of hydrazine statistically demonstrated. UDMH analytical problems prevented demonstration of UDMH linearity of response. GRA

N80-17433# Clemson Univ., S.C.
ON LINE COMPUTER RECALIBRATION OF INSTRUMENTS Final Report, 1 Oct. 1978 - 30 Sep. 1979
R. W. Gilchrist and W. J. Barnett Jul. 1979 134 p
(Contract EY-77-S-09-1011)
(DOE/ET-01011/6) Avail: NTIS HC A07/MF A01

A system for on-line computer recalibration of instruments was developed. The system consists of two computer programs; an off-line data analysis program and an on-line error reduction program. The off-line program accepts extensive calibration data, analyzes it and prepares it for use in the on-line program. The on-line program accepts the instrument observations and corrects for errors according to the current system state. The on-line program is appropriate for use with a microprocessor. Corrections are made for such deterministic errors as bias, linearity, and hysteresis and errors due to system state parameters such as temperature and humidity. DOE

N80-17434# Royal Aircraft Establishment, Farnborough (England). Radio and Navigation Dept.
PRACTICAL ACCELEROMETER TESTING
C. M. Philip London HMSO Dec. 1978 26 p refs
(RAE-TR-78149; BR66986) Avail: NTIS HC A03/MF A01

In calibrating modern inertial quality accelerometers which are accurate to a few parts in a million, extreme care must be exercised in measurement technique and interpretation of the results. Some of the tests which are performed currently with accelerometers are analyzed and the effects of errors in the test equipment are discussed. A mathematical modeling approach is used to explore calibrating methods. Results show that while the conventional four point test remains an important means of monitoring instrument performance, multiposition tests are considered superior when measurements of the highest accuracy are required. Author (ESA)

N80-17435# National Physical Lab., Teddington (England). Div. of Mechanical and Optical Metrology.
UNCERTAINTIES IN THE MEASUREMENT OF GAGE BLOCKS BY INTERFEROMETRY
K. G. Birch May 1979 30 p refs
(NPL-MOM-29) Avail: NTIS HC A03/MF A01

Potential sources of uncertainty in the measurement of gage blocks by interferometry are examined in order to evaluate the total uncertainty in the measured length of a block. The sources of uncertainty evaluated include fringe fraction estimation, gage block temperature measurement, temperature difference between gage block and platen, coefficient of linear expansion of gage material, refractivity of air, phase change on reflection, wringing film thickness, and interferometer parameters. The uncertainties are identified as random or systematic and the summed uncertainty of each type is stated as a two sided confidence interval corresponding to a confidence level of 0.99. A total uncertainty, obtained by combining the random and systematic uncertainties is also derived. Author (ESA)

N80-17436# National Physical Lab., Teddington (England). Div. of Mechanical and Optical Metrology.
A SURVEY OF SECONDARY STANDARD GAGES FOR ACCURATE PRESSURE MEASUREMENT UP TO ABOUT 1 GPa
G. N. Peggs Jan. 1979 22 p refs
(NPL-MOM-37) Avail: NTIS HC A02/MF A01

Secondary standard gages suitable for accurate pressure measurement up to about 1 GPa are reviewed. Several recently developed types of practical gages are discussed and their performance assessed. Results show that there are several constraints on the choice of a suitable secondary standard gage for a particular application, e.g., the number and quality of the leadthroughs required to operate the gage. Author (ESA)

N80-17437# Centre Technique des Industries Mecaniques, Senlis (France).
A THREE DIMENSIONAL ROUGHNESS METER FOR IMPROVED EVALUATION OF SURFACE MICROCONTOURS Final Report [LE RUGOSIMETRE TRIDIMENSIONNEL POUR UNE MEILLEURE EVALUATION DES ETATS DE SURFACE]
Grandadam, Prebe, and Riout 20 Jul. 1979 22 p In FRENCH
(CETIM-1-DD-04-0) Avail: NTIS HC A02/MF A01

A critique of conventional profilometry is given after which a three-dimsional approach to surface roughness characterization is offered. Emphasis is on the misleading nature of two-dimensional cutaway representations of surface contours. As an alternative, a contour following sensor is proposed which provides measurments in three dimensions as it is moved across the surface under investigation. The laboratory apparatus, including the pickup arm, its peripherals, a programmable calculator, and a graphic display, are described. As an example, a milled surface is studied, then compared with standard profilometric data. Results shown that the three-dimensional method does better at analyzing the homogeneity of a surface and that it is more efficient in revealing point defects. Author (ESA)

N80-17438# Environmental Monitoring and Support Lab., Cincinnati, Ohio. Quality Assurance Branch.
ANGULAR FLOW INSENSITIVE PITOT TUBE SUITABLE FOR USE WITH STANDARD STACK TESTING EQUIPMENT Final Report
W. J. Mitchell, B. E. Blagun, D. E. Johnson, and M. R. Midgett Jun. 1979 69 p refs
(PB80-102007; EPA-600/4-79-042) Avail: NTIS HC A05/MF A01 CSCL 13B

Five pitot tube designs were tested under various gas flow conditions for accuracy in measuring static and total pressure. The static and impact pressure measuring tubes least affected by angular flow were combined and then evaluated in the presence of standard particulate sampling nozzles. Tests were performed on 'S', 'L', Kiel and cylinder pitot tubes and a shielded static pressure pitot tube. The percent error for each pitot tube was determined as a function of yaw, pitch, orifice size, orifice location, pitot tube size, and velocity. A pitot tube was developed that is accurate within 5% when yawed and pitched + or - 30 degrees even while attached to a standard EPA Method 5 sampling assembly. This pitot tube was field tested at a sewage sludge incinerator, a clay crushing plant and a power plant. GRA

N80-17285 Paris Univ. (France). Lab. de Mecanique Appliquee.
ADJUSTMENT OF A CONSERVATIVE NON GYROSCOPIC MATHEMATICAL MODEL FROM MEASUREMENT
L. Bugeat, R. Fillod, G. Lallement, and J. Piranda *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 71-81 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-17439 Stanford Univ., Calif.
LASER INDUCED COLLISIONS Ph.D. Thesis
Jonathan C. White 1979 153 p
Avail: Univ. Microfilms Order No. 8002036

A collisional process which permits the rapid and controllable transfer of energy among interacting atomic or molecular species is described. This process, termed a laser induced inelastic collision, results from the long range, dipole-dipole interaction between two species in which a photon is used to satisfy an energy defect. Coupled equations describing the effect are developed and numerically integrated for the transition probability and collision cross section. The numerical results are compared with approximate formula for the cross section at line center and in the wing. Applications for laser induced infrared upconversion, so called radiative collision lasers, and new pair absorption studies are proposed. Dissert. Abstr.

N80-17440 Stanford Univ., Calif.
THEORY OF THE ISOCHRONOUS STORAGE RING LASER Ph.D. Thesis
David Anthony George Deacon 1979 227 p
Avail: Univ. Microfilms Order No. 8006375

The use of an isochronous storage ring as the electron source for a high power, high efficiency free electron laser is proposed. The conditions for the existence of such traps are defined and the dependence of their size and shape on the laser parameters and the deviations from isochronicity in the arc of the storage ring are characterized. The optimization of the laser parameters are discussed and numerical example of its performance is given assuming a design which can be realized in practice. The tolerances on the field strengths and the laser cavity length are derived and it is shown how they can be satisfied in a real facility. Dissert. Abstr.

N80-17441 California Inst. of Tech., Pasadena.
DESIGN, CONTROL, AND CHARACTERIZATION OF THE PASSIVELY MODE LOCKED CW DYE LASER. 1. PHOTOCONDUCTIVE IMPULSE RESPONSE AND EXCESS CARRIER LIFETIME OF Cr-DOPED GaAs, 2 Ph.D. Thesis
Pinchas Agmon 1980 204 p
Avail: Univ. Microfilms Order No. 8000954

Following a description of the laser's elements, the mode stability of its multi-mirror resonator is studied. The monitoring of the laser operational state by pulsewidth and bandwidth measurements is described. A transient photoconductive experiment is conducted. The semi-insulating Cr:GaAs material is irradiated with a continuous train of picosecond light pulses with photon energy above the band-gap energy, generated by the passively mode locked CW dye laser. A photoconductive decay time of 67 psec is deduced from the observations and interpreted as the result of both bulk and surface recombination. It is shown that it agrees well with longer carrier life-time in Cr:GaAs measured under steady state conditions with longer illumination wavelengths. Dissert. Abstr.

N80-17442 California Univ., Berkeley.
DOUBLE MODE-LOCKING OF THE CW DYE LASER Ph.D. Thesis
Etan Bourkoff 1979 219 p
Avail: Univ. Microfilms Order No. 8000291

Double mode-locking of the CW dye laser is investigated. Using cross-correlation techniques, a direct display of the system jitter distribution is experimentally obtained, in addition to displays of the shapes of the primary and secondary double mode-locked pulses, all on a picosecond time scale. It is determined that the primary mode-locked pulse is closely approximated by a single-sided exponential shape, whereas the secondary pulse is, in general, adequately described by a double-sided exponential shape, whose trailing edge contains a slowly-decaying tail. Detailed information on the relative synchronism between the two pulse trains, and on their relative time of generation within the common laser cavity, is also given. An empirical study of some of the important system parameters of double mode-locking is made and a versatile configuration which allows a wide range of independent tunability is demonstrated. Dissert. Abstr.

N80-17443*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PERFORMANCE ANALYSIS OF THE SPACEBORNE LASER RANGING SYSTEM
W. D. Kahn, F. O. Vonbun, D. E. Smith (Business and Technol. Systems, Inc.), T. S. Englar (Business and Technol. Systems, Inc.), and B. P. Gibbs Oct. 1979 26 p refs Submitted for publication
(NASA-TM-80330) Avail: NTIS HC A03/MF A01 CSCL 20E

The 'spaceborne laser ranging system' is a proposed short pulse laser on board an orbiting spacecraft. It measures the distances between the spacecraft and many laser retroreflectors (targets) deployed on the earth's surface. The precision of these range measurements was assumed to be about plus or minus 2 cm. These measurements were then used together with the orbital dynamics of the spacecraft to derive the intersite vector between the laser ground targets. The errors associated with this vector were on the order of 1 to 2 cm. The baseline distances determined range from 25 km to 1200 km. By repeating the measurements of the intersite vector, strain and strain rate errors were estimated. The realizable precision for intersite distance determination was estimated to be on the order of 0.5 cm at 300 km and about 1.5 cm at 1200 km. The corresponding inaccuracies for the intersite distances were larger, than is 1 cm and 3.5 cm respectively. The corresponding precision in the vertical direction was 1 cm and 3 cm. R.E.S.

N80-17444# New York Univ., N. Y. Dept. of Physics.
PHOTON ECHOES IN STANDING WAVE FIELDS: TIME SEPARATION OF SPATIAL HARMONICS
J. L. Legouet and P. R. Berman Sep. 1979 18 p refs
(Contract N00014-77-C-0553)
(AD-A076103) Avail: NTIS HC A02/MF A01 CSCL 20/5

A calculation is presented to describe the response of an atomic system subjected to two strong standing wave field pulses separated in time. One finds a sequence of output pulses following the input ones, reminiscent of classical photon echoes. A physical picture of the processes involved in echo formation is presented and connection is made with the classical picture of photon echoes. The application of these techniques to collision studies is emphasized. It is shown that studies of echoes produced by standing wave fields can prove advantageous for exploring the effects of small angle scattering on both level populations and atomic coherences. GRA

N80-17445# Naval Weapons Center, China Lake, Calif.
LASER DYE PURITY AS DETERMINED BY THIN LAYER CHROMATOGRAPHY Research Report, Nov. 1978 - Aug. 1979
Aaron N. Fletcher and May L. Chan Oct. 1979 27 p
(ZG54581001)
(AD-A076562; NWC-TP-6132) Avail: NTIS HC A03/MF A01 CSCL 20/5

A total of 66 laser dyes have been examined by thin layer chromatography for the presence of impurities using three different solvent systems. Very few dyes were found that could be considered as pure. The specific effect, if any, of the impurities upon the lasing characteristics of the dyes is not known. Further work is needed to determine whether a purer dye would yield better lasing characteristics. A few dyes were shown to degrade while being tested. GRA

N80-17446# IBM Research Lab., Yorktown Heights, N. Y.
STUDY OF LASERS Final Report, 15 Jul. 1976 - 14 Jul. 1979
Peter P. Sorokin 15 Oct. 1979 10 p refs
(Contract DAAG29-76-C-0062)
(AD-A076507; ARO-14016.9-P) Avail: NTIS HC A02/MF A01 CSCL 20/5

Results achieved in four separate laser studies are summarized. Topics covered are (1) time-resolved infrared spectral photography; (2) laser-included thermal explosions; (3) parahydrogen 16 micron tunable source; and (4) a study of the c (triplet) pi (u) state of H2 in discharges. GRA

N80-17447# Defense Intelligence Agency, Washington, D.C.
BIBLIOGRAPHY OF SOVIET LASER DEVELOPMENTS, NO. 38, NOVEMBER - DECEMBER 1978
Sep. 1979 118 p
(AD-A075784; DIA-DST-1740Z-006-79) Avail: NTIS HC A06/MF A01 CSCL 20/5

Coverage includes basic research on solid state, liquid, gas, and chemical lasers; components; nonlinear optics; spectroscopy of laser materials; ultrashort pulse generation; theoretical aspects of advanced lasers; and general laser theory. Laser applications are listed under biological effects; communications; beam propagation; computer technology; holography; laser-induced chemical reactions; measurement of laser parameters; laser measurement applications; laser-excited optical effects; beam-target interaction; and plasma generation and diagnostics. GRA

N80-17448# Naval Postgraduate School, Monterey, Calif.
FREQUENCY CONTROL OF A CO2 LASER USING STARK CELL STABILIZATION M.S. Thesis
Daniel Morris Brown Jun. 1979 122 p refs
(AD-A075210) Avail: NTIS HC A06/MF A01 CSCL 20/5

Preliminary studies have been carried out for the frequency and intensity stabilization of the output of a carbon dioxide laser, by feedback control of resonator length. Fluctuations due to discharge current and temperature and flow rate of coolant were studied. Current regulation of the power supply was found to be necessary for intensity stability. Cavity length tuning allowed vibration-rotation line selection, with a strong hysteresis effect. A computer analysis of error signal production for a pyroelectric detector and for a HgCdTe detector indicated that phase sensitive detection of the first harmonic signal component gave the typical frequency discriminant. Operation of a servo loop integrator for the feedback loop has been considered. A suitable Stark Effect absorption cell for feedback signal generation has been constructed, but has not been applied to the laser. GRA

N80-17449# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.
AUTOMATED LASER SPECKLE INTERFEROMETRY DISPLACEMENT CONTOUR ANALYZER
John A. Schaeffel, Jr. 2 Jul. 1979 43 p refs
(AD-A075109; DRSMI-T-79-1) Avail: NTIS HC A03/MF A01 CSCL 17/8

This work presents a new technique and experimental equipment to analyze Young's Fringe speckle interferograms. A new method using an off-axis optical photodetector was developed for generating displacement contour maps of bodies when deformed under load. Laser speckle interferograms are made of the deformed body and analyzed with a special displacement contouring computer analyzer. Interferograms of a flawed composite tube were analyzed by the system and are presented in the work. Currently operating at about 20% of its maximum rated speed, the system can analyze 5000 data points in less than four minutes. This report presents both the theory and hardware which may be utilized to generate displacement contour maps of deformed bodies. GRA

N80-17450# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
INVESTIGATION OF MILLIMETER WAVE AND FAR INFRARED MULTIWAVELENGTH SYSTEMS Final Report, 1 Jul. 1977 - 31 Mar. 1979
R. G. Shackelford, J. J. Gallagher, R. W. McMillan, G. R. Loefer, and W. M. Penn 17 Sep. 1979 69 p refs
(Contract DAAG29-77-C-0026)
(AD-A075265; GIT/EES-A-1985; ARO-15277.2-A-P) Avail: NTIS HC A04/MF A01 CSCL 17/5

This report summarizes the results of three related tasks performed under the subject contract: Hybrid Millimeter Wave/CO2 Laser Target Acquisition System; Millimeter Wave Propagation Through Battlefield Dust; and Report of NMMW System Subpanel. A full final report has been published on each subtask, and is available through the cognizant Army Organizations. (A GRA

N80-17451# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.
ACTIVE LASER SEEKER CONCEPTS EVALUATION
Khalil Seyrafi and Thomas H. James Jun. 1979 44 p
(AD-A075979; DRSMI-T-CR-79-22) Avail: NTIS HC A03/MF A01 CSCL 17/7

This final report covers the subject of active search and acquisition by a 10.6 micrometer missile seeker. The primary issue is the discrimination capabilities of an active system. Included in this report are performance evaluations in coherent and incoherent modes, compared to passive seekers, evaluations of the viability of several target discriminants, considerations regarding acquisition scan techniques, and economic considerations of such active seeker designs. GRA

N80-17452# Illinois Univ. at Chicago Circle, Chicago. Dept. of Physics.
LASER EXCITATION OF INNER-SHELL ATOMIC STATES BY MULTIQUANTUM PROCESSES Annual Summary Report, 1 Aug. 1978 - 31 Jul. 1979
Charles K. Rhodes and R. Thomas Hawkins 31 Oct. 1979

127 p refs
(Contract N00014-78-C-0625)
(AD-A076068) Avail: NTIS HC A07/MF A01 CSCL 07/4

Multiquantum ultraviolet processes utilizing the available ultrahigh spectral brightness rare gas halogen technology can be used to generate inversion densities 10 to the 15th power/cu cm in the 10-20 eV range. On the basis of current experimental findings we conclude that these nonlinear methods of excitation can be successfully extrapolated to excitations in the 20-50 eV range, the region of excited atomic inner-shell configurations. GRA

N80-17453# Army Electronics Research and Development Command, Fort Monmouth, N. J. Night Vision and Electro-Optics Labs.
DESIGN APPROACH FOR THE VISIOCEILOMETER AN/GMQ-( ) (XE-1) Final Report
Henry Saphow, Frederick Kobylarz, Gunther Kainz, and Earl Griggs Sep. 1979 39 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A076011; DELNV-TR-79-4) Avail: NTIS HC A03/MF A01 CSCL 14/2

This report details the in-house efforts to design, fabricate and test a combination visiometer/ceilometer based upon Laser Rangefinding and CCD technologies. The effort described demonstrated concept feasibility and offers recommendations for implementing future generation equipment. GRA

N80-17454# Hughes Aircraft Co., Culver City, Calif. Laser Systems Div.
PULSED RF WAVEGUIDE STUDIES PROGRAM Research and Development Report, Jul. 1978 - Apr. 1979
L. V. Sutter Aug. 1979 53 p refs
(Contract DAAB07-78-C-2450)
(AD-A073298; HAC-FR79-93-885; DELNV-TR-78-2450-1) Avail: NTIS HC A04/MF A01 CSCL 20/5

The operation of a pulsed RF Waveguide CO2 laser was successfully demonstrated. The efficient passive matching of the RF power supply to the laser head was achieved. Peak powers of up to 400 watts with 150 nanoseconds pulsewidth were obtained at repetition rates of up to 20 kilohertz. Peak small signal gains of up to 2.7 percent/cm were achieved. The pulsed laser was also run CW and thus mixed mode operation is feasible. GRA

N80-17455# Cornell Univ., Ithaca, N. Y. School of Applied and Engineering Physics.
VIBRATIONAL ENERGY TRANSFER AND KINETICS OF HIGH ENERGY MOLECULAR LASERS Final Report, 1 Jun. 1976 - 31 May 1979
T. A. Cool 17 Aug. 1979 9 p refs
(Grant DAAG29-76-G-0252)
(AD-A073592; ARO-13880.1-P) Avail: NTIS HC A02/MF A01 CSCL 20/5

Vibrational energy transfer probabilities were measured for the H2-D2, H2-HCl, HF-HCN, DF-HCN, and H2-HCN systems from 220-450 K. Two-photon photodissociation of HgCl, HgBr, and HgI was observed to produce highly electronically excited (Hg2) atoms. Franck-Condon factors and r-centroids were calculated for the sum of B SQ-sum of X sq systems of HgCl, HgBr, and HgI. GRA

N80-17456# Auburn Univ., Ala. Dept. of Physics.
NUCLEAR PUMPED LASERS
J. R. Williams, M. J. Monahan, and Q. C. Murphree Jul. 1979 56 p refs
(Grant DASG60-77-C-0165)
(AD-A073385) Avail: NTIS HC A04/MF A01 CSCL 20/5

A 3.5 MeV Dynamitron accelerator has been used to investigate low pressure mixtures of Kr-NF3, Xe-NF3, Kr-NF3-UF6, and Xe-NF3-UF6. The accelerator provides low intensity, guassian shaped, pulsed proton beams with FWHM pulse widths of 3 ns and repetition rates of 1 microsec to 32 ms. Emissions from the gas scintillation cell are observed with a single proton counting system. Under existing experimental conditions, the metastable reaction channel dominates the system kinetics, and analysis of experimental results gives formation rate constants, K(1), of 1.7 x 10 to the -10th power cc/sec and 5.5 x 10 to the -11th power cc/sec for the reactions Kr* - NF3 to KrF* - NF2 and Xe* - NF3 to XeF* - NF2, respectively. The results of absolute conversion efficiency measurements show the Xe-NF3 system to be approximately an order of magnitude more efficient than the Kr-NF3 system. The addition of approximately 0.75 torr of UF6 to a 40/2 torr mixture of Kr/NF3 reduces the 2487 A emission by approximately 50%. A 50% reduction in the 3525 A emission from a 40/4 torr mixture of Xe/NF3 is observed when 2 torr of UF6 are added. GRA

N80-17457# ARO, Inc., Arnold Air Force Station, Tenn.
EXPERIMENT EVALUATION OF LASER ATTENUATION BY WATER DROPS Final Report, 2 Jan. - 30 Sep. 1978
J. T. Miller AEDC, Arnold AFS, Tenn. Aug. 1979 30 p refs
(AD-A073430; AEDC-TR-79-18) Avail: NTIS HC A03/MF A01 CSCL 20/6

A test program was conducted to measure the transmission of both CO2 and HeNe laser beams through an attenuation region occupied by water drops. Analysis of the measurements shows that there is reasonable agreement between experiment and diffraction theory and that the major source of uncertainty arises from the characterization of the attenuating particle field. GRA

N80-17458# Stanford Linear Accelerator Center, Calif.
VARIABLE PARAMETER FREE ELECTRON LASER
P. L. Morton Aug. 1979 7 p refs Presented at the ONR Workshop on Electron Generators of Coherent Radiation, Telluride, Colo., 13 Aug. 1979
(Contract EY-76-C-03-0515)
(SLAC-Pub-2371; CONF-790853-1) Avail: NTIS HC A02/MF A01

The use of the free electron laser (FEL) to treat the acceleration of charged particles with radio frequency accelerating systems is described with emphasis on the design of the wiggler magnet used for the FEL. The derivation of the equations are presented in a physically intuitive fashion rather than in a strictly rigorous manner thus showing in a rather graphic way how the variation of the magnetic wiggler field and wave length affects the coupling of the electron energy to the optical laser beam. By proper variation of the wiggler parameters, it is possible to obtain a tremendous improvement in the performance of a variable parameter wiggler over the constant parameter wiggler. DOE

N80-17459# Naval Research Lab., Washington, D. C.
SHORT WAVELENGTH LASERS FOR FUSION Final Report, 1 Apr. 1978 - 31 Mar. 1979
N. Djeu and B. Wexler 1979 37 p refs
(Contract ES-77-A-01-6021)
(DOE/TIC-10163) Avail: NTIS HC A03/MF A01

Two approaches to laser fusion drivers are examined: (1) an optically pumped Hg (63Po-3 yields 6 S-1) energy storage system; (2) metal vapor Raman compression. The feasibility of the first method was investigated by measuring the Hg stimulated emission cross section, which implied a saturation photon fluence in excess of the damage limit on existing window materials. The possibility of obtaining peak power magnification through stimulated Raman scattering was investigated by studying metal vapors as the appropariate Raman medium. The experiments indicate that a XeCl laser in conjunction with Pb vapor constitutes the most promising pump-compressor combination. Compression in excess of 6.7, with photon efficiencies of 42%, has been observed. DOE

N80-17460# Plessey Co. Ltd., Towcester (England). Allen Clark Research Centre.
COMPARATIVE STUDY OF 1.06 MICRON DETECTORS FOR Nd-YAG LASER APPLICATIONS Final Report
R. W. Bicknell and H. Blackburn Jun. 1979 287 p refs
(Contract ESTEC-3501/78-NL-AK(SC))
(CD-6500650/G; ESA-CR(P)-1234) Avail: NTIS HC A13/MF A01

A literature survey is presented, making a comparative study of the state of the art in detectors, detector concepts, and detector technology. The theory and practical considerations of detectors for 1.06 micron laser radiation are discussed and it is shown that only photon detectors which are capable of operating at 400 Mbps at less than 100 nW received power to achieve bit error rates less than 10 to the -6 power. The possibility of improved detector-amplifier combination performance using GaAs FET amplifiers is pointed out. A feasibility study of the growth of compound semiconductor epitaxial layers and manufacturing procedures for producing 1 to 1.6 micron detectors, is presented. Author (ESA)

N80-17461# Atomic Weapons Research Establishment, Aldermaston (England).

THE CONSTRUCTION AND PERFORMANCE OF A TRANSVERSELY EXCITED ATMOSPHERIC PRESSURE LASER (TEAL)

P. L. Eggins, R. J. Prosser, and A. C. Simmons London HMSO Jun. 1979 35 p refs
(AWRE-0-9/79; BR69056; ISBN-0-85518129-X) Avail: NTIS HC A03/MF A01; HMSO £ 1.50; PHI

The construction of a transversely excited atmospheric pressure laser is described with reference to the required specification for single pulse thermal blooming experiments. The performance parameters such as energy, temporal profile, spectrum, and stability are described. Measurements of the spatial profile are compared with theoretical predictions. The results of the pulse stretching experiments, in which the pulse is lengthened from 3 to 14 microsec, are described. Author (ESA)

N80-17462# Compagnie Generale d'Electricite, Marcoussis (France).

A SATURABLE ABSORBER FOR IODINE LASERS Final Report [ABSORBANT SATURABLE POUR LE LASER A IODE]

J. C. Farcy Dec. 1977 55 p refs In FRENCH
(Contract DGRST-76-7-1437)
Avail: NTIS HC A04/MF A01

A saturable absorber for use in a high power pulsed laser system (iodine laser at 1.315 microns) was identified. This absorber (4-diethylamino dithiobenzil nickel diluted with tetral hydrothiophen) was characterized for transmissivity (output power in function of input power; pulse duration reduction) and its relaxation time was deduced based on a model. A passive mode blocking oscillator using this absorber was built and used to generate 500 psec pulses. Author (ESA)

N80-17463# National Physical Lab., Teddington (England). Div. of Quantum Metrology.

A PRACTICAL APPROACH TO THE DESIGN AND CONSTRUCTION OF IODINE STABILIZED LASERS

Andrew J. Wallard Mar. 1979 84 p refs
(NPL-QU-51) Avail: NTIS HC A05/MF A01

The construction and operation of an iodine stabilized helium-neon laser is described. A moderate acquaintance with the physical details of frequency stabilized lasers and the principles of the saturated absorption effect is assumed. A complete set of circuit diagrams for the laser control system is included and the adjustment and operating conditions of the laser are discussed in detail. The performance of the lasers, their limitations, and possibilities for improvement are discussed. A brief description of applications is given. Author (ESA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-17464 California Univ., Berkeley.

STUDY OF JET IGNITION FOR LEAN MIXTURES Ph.D. Thesis

Kevin Yale Teichman 1979 132 p
Avail: Univ. Microfilms Order No. 8000538

The use of jets of active radicals as igniters for lean methane-air mixtures is investigated. The effectiveness of a plasma jet igniter and a combustion jet igniter is examined experimentally and compared to that of a conventional spark. This involved studying each system's fluid dynamic characteristics and ability to extend the flammability limit of lean mixtures. In support of the experimental program, a theoretical study of the effect of radicals on ignition is also carried out. Schlieren flash photographs showed that the gas dynamic properties of the jets are primarily governed by their initial velocity, while the particular process by which they were formed plays a secondary role. The most interesting properties of jet ignition are: (1) a controllable depth of penetration; (2) zonal preturbulization; and (3) a wide dispersion of ignition sources resulting in multipoint ignition. Dissert. Abstr.

N80-17465 Stanford Univ., Calif.

MONOTONICITY ANALYSIS IN ENGINEERING DESIGN OPTIMIZATION Ph.D. Thesis

Panayiotis Yerasimos Papalambros 1979 114 p
Avail: Univ. Microfilms Order No. 8001988

Monontonicity analysis in engineering design problems having many constraints containing functions with extensive monotonic properties is examined. When applicable, it can determine which constraints are active at the optimum. Examination of the possible combinations of active constraints leads to the global optimum. Rules and practices are suggested here for initial modeling of a problem into suitable form for monotonicity analysis. A rigorous step-by-step method is developed to detect monotonic properties and use them to find the global optimum. Qualitative detection of monotonicity directly from differential equations is described. Maximum principles are used to determine the behavior of the solution. A qualitative formulation of the constraints is deduced directly from the boundary conditions. Two design examples are given, one dealing with a reflected-core nuclear reactor and another with an explosive activated cylinder. Dissert. Abstr.

N80-17466*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SPUR-GEAR-SYSTEM EFFICIENCY AT PART AND FULL LOAD

Neil E. Anderson and Stuart H. Loewenthal Feb. 1980 42 p refs Prepared in cooperation with Army Aviation Res. and Develop. Command, Cleveland
(NASA-TP-1622; AVRADCOM-TR-79-46; E-061) Avail: NTIS HC A03/MF A01 CSCL 13I

A simple method for predicting the part- and full-load power loss of a steel spur gearset of arbitrary geometry supported by ball bearings is described. The analysis algebraically accounts for losses due to gear sliding, rolling traction, and windage in addition to support-ball-bearing losses. The analysis compares favorably with test data. A theoretical comparison of the component losses indicates that losses due to gear rolling traction, windage, and support bearings are significant and should be included along with gear sliding loss in a calculation of gear-system power loss. M.G.

N80-17467*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE SENSITIVITY ANALYSIS OF DEPARTMENT OF ENERGY-CHRYSLER UPGRADED AUTOMOTIVE GAS TURBINE ENGINE, S/N 5-4 Final Report

Roy L. Johnsen Dec. 1979 37 p refs
(Contract EC-77-A-31-1040)
(NASA-TM-79242; DOE/NASA/1040-79/9; E-147) Avail: NTIS HC A03/MF A01 CSCL 21A

The performance sensitivity of a two-shaft automotive gas turbine engine to changes in component performance and cycle operating parameters was examined. Sensitivities were determined for changes in turbomachinery efficiency, compressor inlet temperature, power turbine discharge temperature, regenerator effectiveness, regenerator pressure drop, and several gas flow and heat leaks. Compressor efficiency was found to have the greatest effect on system performance. K.L.

N80-17468*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PRECISION RECIPROCATING FILAMENT CHOPPER Patent Application

Austin D. McHatton, Arthur L. Newcomb, Jr., and Gregory Schluge, inventors (to NASA) (Bionetics Corp., Hampton, Va.) Filed 29 Nov. 1979 11 p
(NASA-Case-LAR-12564-1; US-Patent-Appl-SN-098567) Avail: NTIS HC A02/MF A01 CSCL 13I

A chopper for cutting multifilament line is described in which the pull-pull motion of a double edged sliding blade

driven by dual solenoids, provides a chop on each motion. The line is fed by a pair of rollers one of which is driven. The chopped line length and chop rate are independently controlled. A jet airstream is provided to dispense chopped lengths of line.
NASA

N80-17469*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SIMPLIFIED FATIGUE LIFE ANALYSIS FOR TRACTION DRIVE CONTACTS

Douglas A. Rohn, Stuart H. Loewenthal, and John J. Coy 1980 30 p refs Proposed for presentation at 3d Intern. Power Transmission and Gearing Conf., San Francisco, 18-22 Aug. 1980; sponsored by ASME Prepared in cooperation with Army Aviation Res. and Develop. Command, Cleveland
(NASA-TM-79199; AVRADCOM-TR-80-C-4; E-355) Avail: NTIS HC A03/MF A01 CSCL 13I

A simplified fatigue life analysis for traction drive contacts of arbitrary geometry is presented. The analysis is based on the Lundberg-Palmgren theory used for rolling-element bearings. The effects of torque, element size, speed, contact ellipse ratio, and the influence of traction coefficient are shown. The analysis shows that within the limits of the available traction coefficient, traction contacts exhibit longest life at high speeds. Multiple, load-sharing roller arrangements have an advantageous effect on system life, torque capacity, power-to-weight ratio and size. Author

N80-17470*# Chrysler Corp., Detroit, Mich.

MATERIALS REVIEW FOR IMPROVED AUTOMOTIVE GAS TURBINE ENGINE Final Report

C. Belleau, W. L. Ehlers, and F. A. Hagen Apr. 1978 101 p refs Sponsored by NASA
(Contract EY-76-C-02-2749.A011)
(NASA-CR-159673; DOE/NASA/2749-79/4-Vol-4) Avail: NTIS HC A06/MF A01 CSCL 21A

The potential role of superalloys, refractory alloys, and ceramics in the hottest sections of engines operating with turbine inlet temperatures as high as 1370 C is examined. The convential superalloys, directionally solidified eutectics, oxide dispersion strenghened alloys, and tungsten fiber reinforced superalloys are reviewed and compared on the basis of maximum turbine blade temperature capability. Improved high temperature protective coatings and special fabrication techniques for these advanced alloys are discussed. Chromium, columbium, molybdenum, tantalum, and tungsten alloys are also reviewed. Molbdenum alloys are found to be the most suitable for mass produced turbine wheels. Various forms and fabrication processes for silicon nitride, silicon carbide, and SIALON's are investigated for use in highstress and medium stress high temperature environments.
K.L.

N80-17471# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.

APPLICATION OF ELECTRON BEAM WELDING TO HEAVY COMPONENTS

V. Colangelo Jun. 1979 31 p refs
(AD-A076173; ARLCB-MR-79014) Avail: NTIS HC A03/MF A01 CSCL 13/8

The current investigation evaluates the mechanical properties and weld soundness of an electron beam welded casting which was substituted for a complex forging. The mechanical properties obtained were adequate, however, radiographic studies indicated considerable porosity in the welds which was not tolerable. This porosity was the result of the agglomeration of porosity on forged specimens of the same alloy and configuration. The study showed that weldments made from forged sub-sections could meet the mechanical property and soundness requirements. GRA

N80-17472# Naval Postgraduate School, Monterey, Calif.

INVESTIGATION OF WELDING THERMAL STRAINS IN HIGH STRENGTH QUENCHED AND TEMPERED STEEL M.S. Thesis

Mark D. Lipsey Jun. 1978 132 p refs
(AD-A075251) Avail: NTIS HC A07/MF A01 CSCL 11/6

Previous studies of transient thermal strains during welding of high strength quenched and tempered steels are discussed. Data on the transient strain and temperature response during welding experiments on HY-130 and low carbon steel are presented. The experiments consisted of unrestrained, multipass, butt welds in one inch thick plates. The experimental results are compared to analytical predictions by the MIT computer program for the one dimensional analysis of thermal stresses and metal movement during welding. Results indicate that the program accurately predicts the temperature distribution present during welding. However, the program fails to accurately predict the transient strain response except far from the weld line where transverse strains are insignificant. Therefore, the one-dimensional program has limited usefulness for predicting response in thick sections. Recommendations are made which include a comparison of results with a two-dimensional computer analysis and a metallurgical characterization of both the weld metal and the base metal near the weld. GRA

N80-17473# Centre Technique des Industries Mecaniques, Senlis (France).

A REVIEW OF FINISHING PROCEDURES INVOLVING TURNING AND MILLING Final Report [ETUDE BIBLIOGRAPHIQUE. OPERATION DE FINITION EN TOURNAGE ET FRAISAGE]

M. Girard 1 Sep. 1977 70 p refs In FRENCH
(CETIM-1-21-60-0) Avail: NTIS HC A04/MF A01

The machining and finishing of parts, specifically when turning and/or milling operations are involved, are discussed. The literature is reviewed and a state-of-the-art assessment is made. It is concluded that improvement is possible for the cost effectiveness of these operations as well as in reducing lost material and scraps. In support of these findings work parameters affecting the quality of finished surfaces are examined and their influence on the efficiency of machining is verified experimentally. Practical suggestions as to the choice of tool specifications and operating mode to improve finished surface quality are made.
Author (ESA)

N80-17474# Centre Technique des Industries Mecaniques, Senlis (France).

REPORT ON WORK AT CETIM IN THE FIELD OF PRECISION GRINDING. PART 1: RECTIFYING PARAMETERS [ACTION DU CETIM DANS LE DOMAINE DE LA RECTIFICATION. LES PARAMETRES DE RECTIFICATION]

J. C. Tanguy 4 Oct. 1978 34 p refs In FRENCH
(CETIM-1-3D-25-0) Avail: NTIS HC A03/MF A01

The different mechanical parameters which must be considered when rectifying a part with a grinding wheel are discussed. The grinding operation is defined in general terms. The grinding wheel itself is studied in terms of the work surface width and surface length to be rectified. A mathematical model is derived which gives a prediction of the expected result, depending on the job (length and width of cut), the desired precision, and on the geometry of the work surface as well as of the grinding wheel face. Results allow for the adjustment of the grinding machine used, notably feed speed and wheel rpm, as well as providing data useful in designing even more precise grinding wheels. Author (ESA)

N80-17475# Centre Technique des Industries Mecaniques, Senlis (France).

ON THE DIMENSIONING OF BONDED SURFACES Final Report [CALCUL DES DIMENSIONS DES JOINTS COLLES]

J. L. Joubert, D. Benazet, and H. Ancenay Apr. 1979 150 p refs In FRENCH
(CETIM-1-3N-05-0) Avail: NTIS HC A07/MF A01

A method for calculating the surface areas needed to bond two flat plates so that they will not come apart under a predetermined shear load is presented. Rectangular surfaces are considered both theoretically and experimentally. Results show the importance of the glue layer thickness. A linearization of the apparent shear strength of the adhesive is used to give a minumum bonding surface prediction. Theoretical results are compared with measured shear values from destructive traction tests on bonded surfaces. Agreement is satisfactory for structural design purposes. Author (ESA)

N80-17476# Centre Technique des Industries Mecaniques, Senlis (France).

CRITERIA FOR DETERMINING THE SPECIFICATIONS OF ACCORDION TYPE BELLOWS IN REGARDS TO FRENCH STANDARDS FOR PRESSURE APPARATUS Final Report [REGLES DE CALCUL DES COMPENSATEURS DE DILATATION A ONDES EN 'U' POUR LE CODE FRANCAIS DES APPAREILS A PRESSION]
F. Osweiller May 1979 29 p refs In FRENCH
(CETIM-14-B-08-0) Avail: NTIS HC A03/MF A01

Calculation criteria for determining the minimum thickness of expandable joint walls, the number of axial displacement cycles, and the pressure variations which the equipment can withstand are presented. The standards apply to compensators with monolayer dilatation and sides formed of a series of one or more identical U shaped bulges. Each bulge is described as two symmetrical halfwaves with the line portion of the halfwave having a maximum deviation from the vertical, of 8 deg. The possible effects of vibration on the structure are not considered.
Author (ESA)

N80-17477# Centre Technique des Industries Mecaniques, Senlis (France).
REPORT ON WORK AT CETIM ON PRECISION GRINDING, PART 4 [ACTION DU CETIM DANS LE DOMAINE DE LA RECTIFICATION]
M. Tanguy 14 Jun. 1979 56 p In FRENCH
(CETIM-1-3D-25-0) Avail: NTIS HC A04/MF A01

Data relative to the choice of a grinding wheel for a given job are discussed. In service tests on different grades of grinding wheels were carried out and their wear was measured. Results show that the grade of a grinding wheel has an important influence on the work needed to make a cut as well as on the energy consumed during the operation. However, it has little effect on the condition of the finished surface. Surface quality depends on such factors as abrasive grain size, feed speed, wheel rpm, etc. By quantitatively following the wear of a grinding wheel as a function of material it is shown how the choice of grade can increase grinding efficiency and reduce the need for frequent wheel truing. Author (ESA)

N80-17478# Centre Technique des Industries Mecaniques, Senlis (France).
DESIGN SPECIFICATIONS FOR STAMPING TOOLS Final Report [CONTRAINTES DANS LES OUTILLAGES D'ESTAMPAGE]
J. L. Montagut 5 May 1979 109 p refs In FRENCH
(CETIM-1-3K-16-0) Avail: NTIS HC A06/MF A01

A finite element method is presented as a support for the computer assisted design of forming tools used in metal working. Emphasis is on the calculation of the pressing force distribution across the tool surface during forming. Semi-complex part shapes, generally flat or symmetrical, are considered. Numerous applications are cited for calculating tool mechanical load limits leading to a reduction in tool damage due to crack initiation at tool contours. It is also shown that changes in the exterior geometry of the tool have little effect on its service life. The generalized application of this design analysis method to precision forging is discussed. Author (ESA)

N80-17479# Centre Technique des Industries Mecaniques, Senlis (France).
CONCEPT AND CONSTRUCTION OF TORQUES BOLTED ASSEMBLIES Final Report [CONCEPTION OET MONTAGE DES ASSEMBLAGES BOULONNES PRECONTRAINTS]
C. Sayettat Jun. 1979 113 p refs In FRENCH Supsersedes CETIM-1-1G-05-0
(CETIM-1-3N-06-0; CETIM-1-1G-05-0) Avail: NTIS HC A06/MF A01

Theoretical models are developed for optimizing bolted structure geometries, torqued to a specific value. An attempt is made to rationalize the use of bolts while reducing materials costs, but maintaining a specified level of reliability. It is emphasized that these models have not been proven experimentally and suggestions are made for possible tests. Author (ESA)

N80-17480# Centre Technique des Industries Mecaniques, Senlis (France).
A REVIEW OF WORK CONCERNING REDUCTION GEAR TRAINS [ETUDE EXPLORATOIRE DES EFFORTS DANS LES REDUCTEURS PLANETAIRES]
A. Ayel and J. Chalier Apr. 1979 38 p refs In FRENCH
(CETIM-1-4H-30-0) Avail: NTIS HC A03/MF A01

After a review of the literature, theory, and calculation methods regarding the positioning of contact points in multiple gear reduction configurations are discussed. The application of these formulas is demonstrated by analyzing the differences in power transmission, based on the number of contact points during meshing, for different gear train sizes. Finally, examples of various gear teeth ratio dependent reduction designs are shown, being limited to those configurations which could possibly be built.
Author (ESA)

N80-17481# Centre Technique des Industries Mecaniques, Senlis (France).
REPORT ON WORK AT CETIM IN THE FIELD OF PRECISION GRINDING, PART 3 [ACTION DU CETIM DANS LE DOMAINE DE LA RECTIFICATION]
M. Tanguy 12 Apr. 1979 51 p In FRENCH
(CETIM-13-D-25-0-Pt-3) HC A04/MF A01

Tests designed to show the influence of the diamond point on grinding wheel performance and on the characteristics of the finished surfaces are presented. Variables include the type of diamond point (cut stone, recut point, or raw diamond) and the amount of material removed at each adjustment. Steel (100C6) parts were used as work pieces. A first set of experiments involved adjustments to the grinding surface of from 0.05 to 0.8 mn/rev. A second set of experiments, using 35NCD16 steel parts, was based on facing adjustments of 0.1 to 0.4 mm/rev. Combined results show that increasing the diamond facing cut increases the roughness of the finished surface. Changing the diamond type also effects finished surface quality. Author (ESA)

N80-17482# Centre Technique des Industries Mecaniques, Senlis (France).
PREDICTION OF DYNAMIC PROPERTIES OF A ROTOR SUPPORTED BY HYDRODYNAMIC BEARINGS USING THE FINITE ELEMENT METHOD Final Report
J. Peigney 19 Sep. 1979 30 p refs Presented at Intern. Conf. on Eng. Appl. of the Finite Element Method, Oslo, May 1979
(CETIM-1-4A-29-0) Avail: NTIS HC A03/MF A01

General programs for rotor bearing analysis using the finite element method are presented. A consistent representation of both mass and stiffness is used for the rotor shaft while hydrodynamic bearings are calculated by solving a Reynolds equation. Dynamic characteristics of these bearings are then obtained with a perturbation method. These programs are compared with both numerical and experimental results from the literature and agreement is shown to be good. The influence of bearing characteristics on the stability threshold and the unsteady response of a rotor are also studied. Author (ESA)

N80-17483# Centre Technique des Industries Mecaniques, Senlis (France).
CRITERIA FOR DETERMINING THE SPECIFICATIONS OF ACCORDION TYPE BELLOWS BASED ON FRENCH STANDARDS FOR PRESSURE APPARATUS Final Report [REGLES DE CALCUL DES COMPENSATEURS DE DILATATION A ONDES EN U POUR LE CODE FRANCAIS DES APPARGILS A PRESSION]
F. Osweiller 11 Jun. 1979 29 p refs In FRENCH
(CETIM-1-4B-08-0) Avail: NTIS HC A03/MF A01

Calculation criteria for determining the minimum thicknesses of expandable joint walls as well as the number of axial displacement cycles and the pressure variations which these structures can withstand are given. These standards only apply to pressure compensators designed for monolayer dilatation and having sides formed into a series of one or more identical T-shaped bulges. Each bulge is described as two symmetrical half waves. A half wave is formed by a line with curves at each end and having the same arc and arc length. The line portion of the half wave can have a maximum deviation from the vertical of 8 deg. These design criteria do not take into consideration the possible effects of vibration on the structure. Author (ESA)

N80-17484# Transportation Systems Center, Cambridge, Mass.
COMPARISON OF FUEL ECONOMY AND EMISSIONS FOR

DIESEL AND GASOLINE POWERED TAXICABS Final Report, Jun. 1976 - Apr. 1979
K. M. Hergenrother Washington Jul. 1979 30 p
(PB-298609/9; DOT-TSC-UMTA-79-30;
UMTA-MA-06-0066-79-1) Avail: NTIS HC A03/MF A01
CSCL 21D

Potential improvements in fuel economy and exhaust emissions by dieselization of the taxi fleet in a large urban area was assessed. Sixty-six diesel powered taxicabs and an equal number of gasoline powered cabs were operated for 120,000 miles each in three taxicab fleets in New York City. Identical cabs were powered with either 198 CID diesel engines or 225 CID gasoline engines. Test results from all cabs were used to determine fuel economy and exhaust emissions. On the road, the diesel cabs had 50 percent better fuel economy than the gasoline cabs; the diesel exhaust emissions (HC, CO, NOx) were lower than the gasoline exhaust emissions over the life of the test. Emission from the diesels did not appreciably degrade with vehicle age; emission from the gasoline cabs increased appreciably. GRA

N80-17485# National Bureau of Standards, Washington, D.C. Fracture and Deformation Div.
ANALYSIS OF THE PNEUMATIC BURST OF A LARGE SEAMLESS STEEL PRESSURE VESSEL IN NATURAL GAS SERVICE
Bruce W. Christ Mar. 1979 121 p
(Contract DOT-AS-40034)
(PB-300579/0; NBSIR-78-1589) Avail: NTIS
HC A06/MF A01 CSCL 13D

A metallurgical evaluation and fracture analysis was made of a pneumatically-burst seamless steel compressed gas cylinder which was used for over-the-highway transport of natural gas. The cylinder ruptured due to environmentally-assisted cracking. The fracture originated at a part-through crack in a region of high tensile strength. Four other part-through cracks were found in the vicinity of the fracture origin. Up to 500 ppm by volume of hydrogen sulfide was detected in gas samples taken from the natural gas wells after the incident. Evidence of sulfur was found on the fracture origin and on the inside wall. It was concluded that the rupture was due to the internal gas pressure acting on the region of the fracture origin. GRA

N80-17486# Massachusetts Univ., Amherst. Dept. of Mechanical Engineering.
DESIGN FOR MANUFACTURABILITY: NONPRODUCTIVE TIME IN CONVENTIONAL METAL CUTTING (DESIGN FOR MANUFACTURABILITY)
L. Fridriksson and T. Cullinane Feb. 1979 158 p
(Grant NSF APR-77-10197)
(PB-300511/3; NSF/RA-790092; Rept-3) Avail: NTIS
HC A08/MF A01 CSCL 13H

Procedures are determined for estimating the cost of the nonproductive time which occurs during conventional metal cutting. This includes both the cost of material handling between machines, and the nonproductive time required to handle individual parts during machining operations. These times and costs are determined as a function of each part's design. By determining the Optiz code number for a particular part and its mass, it is possible to estimate, through the application of the procedure developed, the nonproductive time and the material handling cost associated with the part's manufacture. GRA

N80-17487# National Technical Information Service, Springfield, Va.
HIGH TEMPERATURE BEARINGS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Oct. 1979
William E. Reed Nov. 1979 174 p Supersedes NTIS/PS-78/1060; NTIS/PS-77/0911; NTIS/PS-76/0784; NTIS/PS-75/716
(PB80-800485; NTIS/PS-78/1060; NTIS/PS-77/0911;
NTIS/PS-76/0784; NTIS/PS-75/716) Avail: NTIS
HC $30.00/MF $30.00 CSCL 13I

The bibliography covers the design, development, applications, and material studies with applications to bearings, gas turbines, nuclear reactors, and space applications. Research on gas bearings, high speed bearings, and lubrication are included. This updated bibliography contains 168 abstracts, 10 of which are new entries to the previous edition. GRA

N80-17488# National Technical Information Service, Springfield, Va.
ROLLER BEARINGS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Oct. 1979
Guy E. Habercom, Jr. Nov. 1979 206 p Supersedes NTIS/PS-78/1110; NTIS/PS-77/0986; NTIS/PS-76/0826; NTIS/PS-75/803
(PB80-800857; NTIS/PS-78/1110; NTIS/PS-77/0986;
NTIS/PS-76/0886; NTIS/PS-75/803) Avail: NTIS
HC $30.00/MF $30.00 CSCL 13I

Design and performance of roller bearings are investigated in these Government-sponsored research reports. Rolling contact bearing surfaces, hardening methods, mechanical properties, and lubricating techniques are among the areas reviewed. This updated bibliography contains 200 abstracts, 17 of which are new entries to the previous edition. GRA

N80-17489# National Technical Information Service, Springfield, Va.
BALL BEARINGS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Oct. 1979
Guy E. Habercom, Jr. Nov. 1979 247 p Supersedes NTIS/PS-78/1119; NTIS/PS-77/0996; NTIS/PS-76/0885
(PB80-800840; NTIS/PS-78/1119; NTIS/PS-77/0996;
NTIS/PS-76/0885) Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

Design and performance of ball bearings are investigated in these reports gathered in a worldwide literature survey. Wear resistance, lubrication means and effectiveness, and physical properties are among the parameters reviewed. This updated bibliography contains 242 abstracts, 36 of which are new entries to the previous edition. GRA

N80-17490# National Technical Information Service, Springfield, Va.
BALL BEARINGS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Sep. 1979
Guy E. Habercom, Jr. Nov. 1979 237 p Supersedes NTIS/PS-78/1118; NTIS/PS-75/806
(PB80-800832; NTIS/PS-78/1118; NTIS/PS-77/0995;
NTIS/PS-76/0884; NTIS/PS-75/806) Avail: NTIS
HC $30.00/MF $30.00 CSCL 13I

Design and performance of ball bearings are investigated in these Government-sponsored research reports. Wear resistance, lubrication means and effectiveness, and physical properties are among the parameters reviewed. This updated bibliography contains 227 abstracts, 13 of which are new entries to the previous edition. GRA

N80-17491# National Technical Information Service, Springfield, Va.
ROLLER BEARINGS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Oct. 1979
Guy E. Habercom, Jr. Nov. 1979 236 p Supersedes NTIS/PS-78/1111; NTIS/PS-77/0987; NTIS/PS-76/0887
(PB80-800865; NTIS/PS-78/1111; NTIS/PS-77/0987;
NTIS/PS-76/0887) Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

Design and performance of roller bearings are investigated in these reports gathered in a worldwide literature survey. Rolling contact bearing surfaces, hardening methods, mechanical properties, and lubricating techniques are among the areas reviewed. This updated bibliography contains 244 abstracts, 30 of which are new entries to the previous edition. GRA

N80-17266 Arya Mehr Univ. of Technology, Teheran (Iran). Dept. of Mechanical Engineering.
MULTI-VARIABLE OPTIMIZATION FOR VIBRATION ISOLATION OF ROAD VEHICLES
Ebrahim Esmailzadeh *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 85-96 refs
(For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington D.C.

N80-17267* Lord Kinematics, Erie, Pa.
ISOLATION MOUNTS FOR THE HEAO-B X-RAY TELESCOPE
H. L. Hain and R. Miller (American Science and Engineering, Inc., Cambridge, Mass.) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 97-113 refs (For primary document see N80-17258 08-31)
(Contract NAS8-30750)
Avail: NRL, Tech. Inform. Div., Washington D.C. CSCL 13I

N80-17288 Concordia Univ., Montreal (Quebec).
RANDOM FATIGUE DAMAGE APPROACH TO MACHINERY MAINTENANCE
T. Seshadri Sankar, G. D. Xistrix, and G. L. Ostiguy *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 103-114 refs Prepared jointly with Ecole Polytechnique, Montreal (Quebec) (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17298*# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
EVALUATION OF ROTOR-BEARING SYSTEM DYNAMIC RESPONSE TO UNBALANCE
Roger E. Thaller and David W. Ozimek *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 41-53 refs (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 13I

N80-17300*# Gilbert/Commonwealth, Jackson, Mich.
EXPERIMENTAL INVESTIGATION OF DYNAMIC CHARACTERISTICS OF TURBINE GENERATORS AND LOW-TUNED FOUNDATIONS
S. P. Ying, M. E. Forman, and R. R. Drumm *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 69-77 refs Prepared in cooperation with Pennsylvania Power and Light Co., Allentown (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 21E

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-17492 California Univ., Berkeley.
RELIABILITY SYSTEMS WITH EXPONENTIAL DISTRIBUTED COMPONENT LEVELS Ph.D. Thesis
Yu-Song Yen 1979 86 p
Avail: Univ. Microfilms Order No. 8000584

Two problems are studied: the allocation of resources and the concept of the reliability importance of each component. The most important component of the system is determined by using Schur convex/concave properties of system reliability functions. Dissert. Abstr.

N80-17493 Centre Technique des Industries Mecaniques, Senlis (France).
A REVIEW OF THE DETECTION OF THE NATURE AND GEOMETRY OF INTERNAL FLAWS AND PITS. PART 2: FOCUSING ULTRASONIC BEAMS Final Report [CONNAISSANCE DE LA LOCALISATION DE LA NATURE ET DE LA FORME DANS L'ESPACE DES DEFAUTS INTERNES ET DEBOUCHANTS]
C. Flambard, A. Lambert, J. Rivenez, and Y. Pralus 28 Aug. 1979 16 p refs In FRENCH 4 Vol.
(CETIM-1-5H-05-0-Pt-2A) Avail: NTIS HC A02

The literature on the focusing of ultrasonic beams is reviewed. Abstracts of the documents cited are given and pertinent conclusions are summarized. These include a function for the variation of the echo intensity as a point of reference and the possibility of rotating the target to decrease the intensity of a given echo. Emphasis is on the dimensioning of flaw geometries. Approximately 80 bibliographies are included. Author (ESA)

N80-17494 Centre Technique des Industries Mecaniques, Senlis (France).
THE DEFINITION AND ADAPTATION OF ACOUSTIC BEAMS FOR ULTRASONIC INSPECTION. PART 4: BIBLIOGRAPHY Final Report [LA DEFINITION ET L'ADAPTATION DU FAISCEAU ACOUSTIQUE EN CONTROLE PAR ULTRASONS]
A. Lambert and Y. Pralus 18 May 1979 10 p refs In FRENCH 4 Vol.
(CETIM-1-5H-10-0-Pt-4) Avail: NTIS HC A02

The use of focused ultrasonic acoustic beams for nondestructive parts inspection is considered. The structures of acoustic fields around transducers are analyzed theoretically. A traditional definition of the acoustic field of a phase transducer is presented. The influence of a focusing lens is then examined. Results show that two models for representing these beams are possible. One is based on a focal point concept, the other on the beam width. Agreement between the practical characterization of these beams and the theoretical models developed is good, provided that the analysis of the beam is carried out under precisely controlled conditions. How these models can be used to characterize transducers for ultrasonic inspection is shown. Author (ESA)

N80-17495# Villanova Univ., Pa. Dept. of Mechanical Engineering.
AEROSTRUCTURE NONDESTRUCTIVE EVALUATION BY THERMAL FIELD TECHNIQUES Final Report, 17 Mar. 1978 - 17 Jan. 1979
P. V. McLaughlin, Jr., E. V. McAssey, Jr., and R. C. Deitrich 1 Nov. 1979 40 p refs
(Contract N68335-78-M-5337)
(AD-A076541; NAEC-92-131) Avail: NTIS HC A03/MF A01 CSCL 14/2

Certain types of flaws and damage in composite materials are not readily observable by visual examination. Examples of these are delaminations, blindside impact damage, and sub-surface laminar cracks. Programs are currently underway to develop methods of detecting such flaws by many techniques, among which are X-ray, neutron radiography, ultrasonic transmission and reflectance, eddy current, and thermography. This report describes results of an experimental and analytical research investigation to evaluate infrared thermography as an NDE tool to locate structural damages which are not easily located by visual examination. Also discussed are possible applications to aluminum structures. GRA

N80-17496# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Electronique et Physique.
THE RELATIONSHIPS BETWEEN FAILURE RATES AND ELECTRICAL PARAMETERS OF ELECTRONIC COMPONENTS [RELATIONS ENTRE LES TAUX D'AVARIE ET LES PARAMETRES ELECTRIQUES DES COMPOSANTS ELECTRONIQUES]
Vinod Kumar and Louis-Francois Pau Dec. 1978 25 p refs In FRENCH; ENGLISH summary
(ENST-D-78017) Avail: NTIS HC A02/MF A01

An attempt to relate the electrical parameters of electronic components to their failure rates is described. Problems concerning the availability and use of data regarding the failure rate and electrical parameters of components are discussed with emphasis on the variety of test methods and the data sources for the components. Explicit relations between the failure rates of the discrete components (active and passive) and their electrical parameters are calculated and tabulated; the failure rate and parameter data are included. The failure mechanisms of integrated circuits (SSI, MSI, and LSI) are discussed as an aid to finding the informative parameters of such components. Author (ESA)

N80-17497# Centre Technique des Industries Mecaniques, Senlis (France).
A REVIEW OF THE DETECTION OF THE NATURE AND GEOMETRY OF INTERNAL FLAWS AND PITS. PART 1: ULTRASONICS Final Report [CONNAISSANCE DE LA LOCALISATION DE LA NATURE ET DE LA FORME DANS L'ESPACE DES DEFAUTS INTERNES ET DEBOUCHANTS]
C. Flambard, A. Lambert, J. Rivenez, and Y. Pralus 28 Aug. 1979 17 p refs In FRENCH 4 Vol.
(CETIM-1-5H-05-0-Pt-1) Avail: NTIS HC A02/MF A01

Various techniques of ultrasonic flaw detection are reviewed. Methods covered include the Pohlmann cell, the ultrasonic camera, echogram generators, and holography. The reflected echos method is cited as being generally the most reliable to date. However, none of the methods examined satisfactorily detects dimensional characteristics of flaws. Holography was considered the most promising approach to this problem, yet with the advent of focused transducers, interest has somewhat shifted away from this technique. Author (ESA)

N80-17498# Centre Technique des Industries Mecaniques, Senlis (France).

A REVIEW OF THE DETECTION OF THE NATURE AND GEOMETRY OF INTERNAL FLAWS AND PITS. PART 2B: SPECTRAL ANALYSIS OF ULTRASONIC ECHOES Final Report [CONNAISSANCE DE LA LOCALISATION DE LA NATURE ET DE LA FORME DANS L'ESPACE DES DEFAUTS INTERNES ET DEBOUCHANTS]

C. Flambard, A. Lambert, J. Rivenez, and Y. Pralus 28 Aug. 1979 37 p refs In FRENCH 4 Vol.
(CETIM-1-5H-05-0-Pt-2B) Avail: NTIS HC A03/MF A01

The literature on the spectrum analysis of ultrasonic echoes is reviewed and abstracts of the most significant documents cited are given/ Main topics considered include dual-frequency ultrasonic echo testing, the determination of defect geometry through frequency analysis, broadband ultrasonic techniques, the characterization of flaws by ultrasonic spectroscopy in amplitude and in phase, and ultrasonic beam diffraction by artificial flaws. Emphasis is on possible industrial applications of ultrasonics for quality control. Author (ESA)

N80-17499# Centre Technique des Industries Mecaniques, Senlis (France).

A REVIEW OF THE DETECTION OF THE NATURE AND GEOMETRY OF INTERNAL FLAWS AND PITS. PART 4: ULTRASONIC SPECTRAL ANALYSIS EXPERIMENTATION Final Report [CONNAISSANCE DE LA LOCALISATION DE LA NATURE ET DE LA FORME DANS L'ESPACE DES DEFAUTS INTERNES ET DEBOUCHANTS]

C. Flambard, A. Lambert, J. Rivenez, and Y. Pralus 30 Aug. 1979 39 p In FRENCH 4 Vol.
(CETIM-1-5H-05-0-Pt-4) Avail: NTIS HC A03/MF A01

The design and construction of laboratory equipment for the study of echoes diffracted by defects in otherwise homogeneous mediums are described. A rig for controlling the orientation of the sonde as well as the measurement instrumentation are covered. Preliminary tests results along with the data acquisition system are shown and the theory of spectral analysis for acoustic emission lines, both of echo intensity and pulse beam deflection, is given. Results indicate the validity of ultrasonic spectroscopy for determining the dimensions of defects in solid or liquid mediums. Author (ESA)

N80-17500# Centre Technique des Industries Mecaniques, Senlis (France).

THE DEFINITION AND ADAPTATION OF ACOUSTIC BEAMS FOR ULTRASONIC INSPECTION. PART 2: ULTRASONIC TRANSDUCERS FOR FOCUSED BEAMS Final Report [LA DEFINITION ET L'ADAPTATION DU FAISCEAU ACOUSTIQUE EN CONTROLE PAR ULTRASONS]

A. Lambert and Y. Pralus 13 Jun. 1979 43 p In FRENCH 4 Vol.
(CETIM-15-H-10-0-Pt-2) Avail: NTIS HC A03/MF A01

The use of focused ultrasonic acoustic beams for nondestructive parts inspection is considered. The structures of acoustic fields around transducers are analyzed theoretically and a traditional definition of the acoustic field of a plane transducer is presented. The influence of a focusing lens is then examined. Results show that two models representing these beams are possible. One is based on a focal point concept, the other on the beam width. Agreement between the practical characterization of these beams and the theoretical models is good, provided that the analysis of the beam is carried out under precisely controlled conditions. The use of these models to characterize transducers for ultrasonic inspection is demonstrated. Author (ESA)

N80-17501# Centre Technique des Industries Mecaniques, Senlis (France).

INTEGRATED INSPECTION OF LARGE, DROP FORGED PARTS: RESULTS TO DATE USING ULTRASONIC FLAW DETECTION [CONTROL INTEGRE DES PIECES DE GROSSE FORGE: RESULTATS ACTUELS]

J. Rivenez and B. Bossuat 9 Apr. 1979 34 p In FRENCH
(CETIM-1-5H-19-0) Avail: NTIS HC A03/MF A01

Different ultrasonic inspection techniques were tested. In most cases parts coming from a drop forge procedure, with large dimensions, and not yet having undergone finishing procedures, were inspected. Problems, such as detection of defects in the presence of parasite echoes and the rapid and accurate handling of the acquired data, are considered. Results are not conclusive. Practical application of this technique was not achieved, mainly due to difficulties in eliminating background noise effects. Several possible solutions are suggested. It is also noted that the test conditions were not as severe as one might expect in many industrial applications. Author (ESA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-17502 California Univ., Berkeley.

THE ELASTOSTATIC AXISYMMETRIC PROBLEM OF CRACKED SPHERE EMBEDDED IN A DISSIMILAR MATRIX Ph.D. Thesis

Rishi Kant 1979 79 p
Avail: Univ. Microfilms Order No. 8000395

The elastostatic axisymmetric problem of a sphere, containing a centrally located penny shaped crack, embedded in a dissimilar matric subject to far field loads was solved by using Boussinesq stress functions. There were two coordinate systems - oblate spheroidal for representing the crack surface and spherical polars for the spherical surface - used to satisfy boundary conditions. Integral representations and transformations of harmonic functions were used to relate stress functions in the two coordinate systems. This procedure led to a system of algebraic equations which were solved, for axisymmetric tractions on both the surfaces. This solution was then used to obtain the solution of the original problem. A representation of the solution for the axisymmetric problem of a crack in an infinite medium is also presented. Dissert. Abstr.

N80-17503 Stanford Univ., Calif.

ACOUSTOELASTICITY: STRESS MEASUREMENTS USING ULTRASONICS Ph.D. Thesis

George Carver Johnson 1979 136 p
Avail: Univ. Microfilms Order No. 8001945

The nondestructive testing technique acoustoelasticity is presented as a method for the evaluation of stress within a specimen. This method makes use of changes in acoustic wave speed as the stress within the body changes. Velocity changes of plane waves as functions of stress and strain are developed in general form using the theory of elasticity. The equations for the velocities are shown to be linear in stress and strain when the material strain energy function is assumed to include terms through third order in strain. The theoretical basis for making the measurements in terms of frequency changes is presented. Dissert. Abstr.

N80-17504 Stanford Univ., Calif.

INFLUENCE OF FINE PARTICLES ON MECHANICAL BEHAVIOR OF POLYCRYSTALLINE SOLIDS Ph.D. Thesis

Jer-hong Lin 1979 205 p
Avail: Univ. Microfilms Order No. 8001961

A phenomenological equation was proposed to described the creep behavior of oxide dispersion strengthened materials with emphasis on TD-Nichrome. Thermal-mechanical processing treatments were developed for attainment of fine microstructures in the 52100 bearing steel. Three mechanical properties were assessed for a 52100 bearing steel with an ultrafine structure. A unique transformation product, called the divorced eutectoid, was observed in the processed ultrafine microstructure 52100 bearing steel. Another high carbon speciality steel, 01 cold work steel, was made superplastic by the methods developed from previous studies on the 52100 bearing steel. Dissert. Abstr.

N80-17505 Iowa State Univ. of Science and Technology, Ames.

STUDIES ON THE YIELD BEHAVIOR OF PHOTOPLASTIC MATERIALS **Ph.D. Thesis**

Jose Luiz deFranca Freire 1979 100 p
Avail: Univ. Microfilms Order No. 8000134

The influences of strain rate and temperature on the yield strength of several polyester materials and polycarbonate were studied. The initial yield locus for both materials is well represented in the tension-compression quadrant by a pressure modified von Mises criterion. The photoplastic method of analzying unloaded models after using slicing techniques is discussed and applied to a plane strain compression example and to the axisymmetric compression of cylinders. A nonlinear finite element program, NONSAP, was employed to obtain solutions, based on von Mises and Drucker-Prager criteria, for the plane strain example in order to compare results. It is shown that photoplastic methods and finite element techniques can be combined to obtain solutions which would be difficult to verify if either method were used independently. Dissert. Abstr.

N80-17506# Aeronautical Research Labs., Wright-Patterson AFB, Ohio.

THE FRACTURE OF A PARACHUTE HOOK: A CASE STUDY OF THE ROLE OF MATERIALS PARAMETERS IN RELIABILITY ANALYSIS

L. R. F. Rose and B. J. Wicks 1979 28 p refs
(ARL-MAT-Note-125; AR-001-591) Avail: NTIS HC A03/MF A01

A detailed analysis of the risk of failure for the particular case of a parachute hook is used to illustrate what information is required for that purpose, how much of it is readily available, and in what areas further research is needed. The analysis relies on the use of a full scale test to identify the mode of failure and hence the relevant strength parameter. It is concluded that an important role of materials research is to provide an understanding of the factors which can affect mechanical properties, so that the characteristics of the relevant population of structures or components may be more precisely defined, and the variability in strength which can be expected in service may be estimated. A number of topics for further research are discussed, but the practical value of this research will depend on the precision of the results obtained and this cannot be determined beforehand. Author

N80-17507# Aeronautical Research Labs., Melbourne (Australia).

THREE DIMENSIONAL VIBRATIONS IN A RECTANGULAR BAR

T. G. Ryall Oct. 1978 19 p refs
(ARL/Struc-Rept-373; AR-001-306) Avail: NTIS HC A01/MF A01

An analysis of the free vibrations of a rectangular bar which is semi-infinite in all directions is presented. It is shown that there are six possible types of vibration which allow three adjacent surfaces to be free from normal stress. Three of these vibrations correspond to a corner rotating and the remaining three correspond to a corner translating. The vibration of a rubber block, which as a Poisson's ratio of 0/5, is discussed, and the results illustrate how these fundamental solutions combine to give a free vibration. M.G.

N80-17508# National Aerospace Lab., Amsterdam (Netherlands).

ADDITIONAL INFORMATION ABOUT FALSTAFF

J. B. DeJonge 6 Dec. 1979 13 p refs
(NLR-TR-79056-U; ICAF-1133) Avail: NTIS HC A02/MF A01

The defining properties are described for a standard load sequence considered representative of the load time history in the lower wing skin near the wing root of a fighter aircraft. The complete FALSTAFF sequence of numbers, ranging from 1 to 32, represents 200 'flights', and consists of 35966 numbers equally distributed over peaks and troughs. The program does not define the way, both with regard to shape and time, in which the load varies between a trough and a peak. The complete Markov-matrix plus tabulations and level crossings pertaining to the FALSTAFF-sequence are presented. A.R.H.

N80-17509# Boeing Co., Wichita, Kans.

EVALUATION OF THE CRACK GAGE CONCEPT FOR MONITORING AICRAFT FLAW GROWTH POTENTIAL, VOLUME 2 **Final Report, 1 Jul. 1977 - 1 Dec. 1978**

Gary G. Cassatt Jun. 1979 262 p
(Contract F33615-77-C-5023)
(AD-A076320; AFML-TR-79-4037-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 01/3

The results of a test program to evaluate the ability of a bonded-on precracked coupon to monitor the growth of flaws in the basic structure are included. All testing utilized 7075-T651 aluminum from a single plate. Both constant thickness and stepped crack gages were evaluated. Evaluation of a wide range of sensitivity in crack gage crack growth response was made. Structure flaws of (1) corner flaw at a hole, (2) through flaw at a hole, and (3) center notch flaw were evaluated. The cyclic test loading included constant amplitude of two R ratios and three representative aircraft usage flight profiles. Strain gage instrumentation was used to measure structure stresses and load transferred into the crack gages. GRA

N80-17510# Boeing Co., Wichita, Kans.

EVALUATION OF THE CRACK GAGE CONCEPT FOR MONITORING AIRCRAFT FLAW GROWTH POTENTIAL VOLUME 1. TECHNICAL DISCUSSION **Final Report, 1 Jul. 1977 - 1 Dec. 1978**

Gary G. Cassatt Jun. 1979 112 p refs
(Contract F33615-77-C-5073)
(AD-A076421; AFML-TR-4037 Vol-1) Avail: NTIS HC A06/MF A01 CSCL 01/3

The results of a test program to evaluate the ability of a bonded on precracked coupon to monitor the growth of flaws in the basic structure are included. All testing utilized 7075-T651 aluminum from a single plate. Both constant thickness and stepped crack gages were evaluated. Evaluation of a wide range of sensitivity in crack gage crack growth response was made. Structure flaws of, (1) corner flaw at a hole, (2) through flaws at a hole and (3) center notch flaw were evaluated. The cyclic test loading included constant amplitude of two R ratios and three representative aircraft usage flight profiles. Strain gage instrumentation was used to measure structure stresses and load transferred into the crack gages. GRA

N80-17511# Pennsylvania State Univ., University Park. Applied Research Lab.

VIBRATION OF PLATES OF VARIOUS GEOMETRIES **Ph.D. Thesis**

Earl G. Williams 17 Jun. 1979 158 p refs
(Contract N00024-79-C-6043)
(AD-A076185; ARL/PSU/TM-79-130) Avail: NTIS HC A08/MF A01 CSCL 11/6

Point driven, flat, thin aluminum plates of various geometries with free boundaries are studied in this thesis. We have applied a theory which allows the mean of the driving point admittance to be predicted over a wide frequency range at any point on these plates. This prediction is compared to the experimentally determined admittance. Also, the expected minimum and maximum variations about this mean are predicted and compared to the experimental data over a broad frequency range. Measured loss factors for these free plates were used in the theoretical models. The actual admittance versus frequency for a center driven rectangular plate was predicted using a mode sum technique and compared to measured data. A simple algebraic formula was used to predict the resonance frequencies of the rectangular and square plates with free boundaries. The transfer admittance of these point driven plates was also measured experimentally and compared to a theory which predicts the mean admittance versus frequency. The dependence of this mean on plate size and also on plate damping was demonstrated. GRA

N80-17512# State Univ. of New York at Buffalo. Dept. of Engineering Science.

CREEP DAMAGE UNDER ONE-DIMENSIONAL VARIABLE

TENSILE STRESS Summary Report
F. A. Cozzarelli and G. Bernasconi Sep. 1979 33 p refs
(Contract N00014-75-C-0302)
(AD-A075780; REPT-114) Avail: NTIS HC A03/MF A01 CSCL 20/11

A nonlinear damage relation, containing the axial strain history and a time integral over the stress history, is proposed for the case of one-dimensional time dependent tensile stress. Nonlinear steady and transient creep terms are included in the axial strain relation, and elastic and creep Poisson's ratios are introduced into the lateral strain relation. Using these relations, complete damage solutions are obtained for the constant stress rate, step stress, relaxation and constant load tests. Observations are made concerning the associated rupture times. GRA

N80-17513# Southwest Research Inst., San Antonio, Tex.
FATIGUE-MICROCRACK BEHAVIOR UNDER THE INFLUENCE OF SURFACE RESIDUAL STRESSES Interim Report, 1 Aug. 1978 - 31 Jul. 1979
J. E. Hack and G. R. Leverant 1 Oct. 1979 42 p refs
(Contract N00014-78-C-0674)
(AD-A075285) Avail: NTIS HC A03/MF A01 CSCL 20/11

Direct observations of the surface crack opening displacement (SCOD) of surface microcracks have been performed on samples of Ti-6Al-4V under both cyclic and static loading conditions. The observations were conducted in a specially-designed loading stage in-situ in a scanning electron microscope. SCOD's of cracks as small as 7 microns in surface length have been studied with this technique. Preliminary results have indicated that crack opening is purely elastic for the strain range studied although a significant residual opening is apparent when no load is applied. Concurrent with the experimental efforts, an analytical approach has been developed to predict SCOD for both elastic and plastic loading conditions based on crack geometry. The correlation between predicted SCOD values and independent data for microcracks is excellent. The approach will be modified to account for the influence of an imposed residual stress field and compared to experimental results on microcrack behavior. GRA

N80-17514# Naval Postgraduate School, Monterey, Calif.
VIBRATION OF A CANTILEVER BEAM THAT SLIDES AXIALLY IN A RIGID FRICTIONLESS HOLE
Arthur P. Boresi and David Salinas Sep. 1979 24 p refs
(AD-A075944; NPS-69-79-009) Avail: NTIS HC A02/MF A01 CSCL 13/13

This paper considers a cantilever beam which can move in and out of a rigid frictionless hole. Hamilton's principle is used for the development of two governing equations, and boundary conditions defined over a moving boundary. A transformation of coordinates is used to transform the problem into a system of two nonlinear p.d.e. defined over a fixed region. A discussion of some mathematical and physical considerations is presented. Finally, a finite element formulation of the problem is presented. GRA

N80-17515# Catholic Univ. of America, Washington, D. C. Dept. of Physics.
RESONANT SCATTERING OF ELASTIC WAVES FROM SPHERICAL SOLID INCLUSIONS Technical Report, 1 Feb. 1979 - 30 Jun. 1980
Lawrence Flax and Herbert Neberall Sep. 1979 44 p refs
(Contract N00014-76-C-0430; RR0110801)
(AD-A075659) Avail: NTIS HC A03/MF A01 CSCL 20/11

Previous investigations concerning the scattering of elastic waves from solid spherical inclusions have furnished expressions for the scattering cross sections which, upon numerical evaluation, exhibited resonance-like features as a function of frequency. In the present work, we study these resonances in a fashion suggested by the resonance theory of acoustic scattering. The resonances of the solid inclusions, exemplified by iron or lucite spheres imbedded in an aluminum matrix, are found numerically in the individual normal-mode scattering amplitudes, and are interpreted in terms of phase-matched circumferential waves. Dispersion curves for the phase velocities of the latter are obtained, exhibiting two families of waves of different type. Finally, the connection of these waves with the Stoneley waves on the boundary between two flat half-spaces is noted in the high-frequency limit. GRA

N80-17516# Centre Technique des Industries Mecaniques, Senlis (France).
ON RESIDUAL CHARACTERISTICS IN MATERIALS: THEIR ORIGIN, INFLUENCE, AND MEASUREMENT Final Report [OUVRAGE CONTRAINTES RESIDUELLES. ORIGINE, INFLUENCE, MESURE]
Chabenat, Flavenot, and Niku-Lari 7 Feb. 1979 325 p refs In FRENCH
(CETIM-1-1D-05-0) Avail: NTIS HC A14/MF A01

The stress-strain mechanisms governing the formation of residual plastic deformations in anisotropic materials experiencing various thermal and/or mechanical stresses during manufacturing are investigated. The influence of this residual stress 'memory' on the measurable characteristics of materials is shown. Different measurement methods, destructive tests, and nondestructive tests are then described and compared. Results show that the accuracy of these tests procedures are no longer in question. However, the application of residual stress measurement on an industrial basis is still beyond corporate means, mainly due to complexity in making measurements and to the prohibitive cost of measurement equipment and its associated data analysis. Author (ESA)

N80-17517# Centre Technique des Industries Mecaniques, Senlis (France). Dept. of Statique et Dynamique des Structures.
STUDY OF THE ELASTIC FLARING OF SHELLS HAVING ANY GEOMETRY Final Report [ETUDE DU FLAMBEMENT ELASTIQUE DES COQUES DE GEOMETRIE QUELCONQUE]
F. Boyer, F. Nasarre, S. Nor, and G. Verchery 9 Mar. 1979 154 p In FRENCH; ENGLISH summary Prepared in cooperation with Univ. de Technol. de Compiegne
(Contracts DGRST-75-7-1413; DGRST-75-7-1414)
(CETIM-11-A-07-0) Avail: NTIS HC A08/MF A01

The structural instability of general elastic shells was studied for the case of bifurcation as well as for softening. Finite element computer programs were developed with two types of elements. A three dimensional degenerated isoparametric element was used for equilibrium bifurcation and an Ahmad type isoparametric shell element with variable shape and number of nodes was employed for large displacement. Results show that the behavior of the three-dimensional element is satisfactory provided that some modification is introduced. The Ahmad shell element is effective, but somewhat cumbersome in the nonlinear case. Author (ESA)

N80-17518# Technische Hochschule, Aachen (West Germany). Inst. fuer Luft u. Raumfahrt.
COLLECTION AND ANALYSIS OF IN SERVICE FLIGHT HISTORIES OF THE INITIATION OF FATIGUE DAMAGE [SAMMLUNG UND ANALYSE VON IM BETRIEB VON LUFTFAFR ZEUGEN AUFGETRETENEN ERMUEDUNGSSCHAEDEN]
H. Huth and D. Schuetz Bonn Dokzentbw Apr. 1979 36 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(Contract T/RF43/RF-430/51038)
(BMVG-FBWT-79-10) Avail: NTIS HC A03/MF A01; Dokzentbw, DM 30

In-service aircraft failure histories are evaluated in order to show weak points of design and causes of early fatigue inititation. The distribution and frequency of fatigue cracks in the different structural components show that the main problem is in the joints. The crack lengths of service and test failures at the time of detection are also evaluated. The principal causes of damage are found to be excessive load transfer, double stress concentration, design stress, induced deflections, secondary bending, sharp edge, open hole, and production defects. These causes are explained using examples taken from the collection of cracks. Author (ESA)

N80-17519# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
ON THE FATIGUE LIFE EVALUATION OF JOINTED SPECIMENS UNDERGOING LOAD TRANSFER WITH REGARD TO STRESS CONCENTRATION [ZUR LEBENSDAUERABSCHAETZUNG VON FUEGUNGEN MIT SCHUBBEANSPRUCHTEN BEFESTIGUNGSELEMENTEN UNTER BERUECKSICHTIGUNG DER LASTUEBERTRAGUNG]

J. Franz and D. Schuetz Bonn Dokzentbw Apr. 1979 96 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(Contract T/RF-43/RF-430/51038)
(BMVG-FBWT-79-11) Avail: NTIS HC A05/MF A01; Dokzentbw, DM 30

The methods of fatigue life evaluation for jointed parts in aircraft structures show great uncertainties, a fact which is indicated by the numerous and in many cases early occurences of fatigue failures in such components. These uncertainties are caused by the insufficient consideration of important parameters, which influence fatigue life decisively, during the design phase. The influence of two parameters, load transfer, and secondary bending stresses, on the fatigue life of jointed specimens were investigated. Results show that for the performance of a reliable fatigue life evaluation, it is important to determine the load transfer and the secondary bending stresses either theoretically or experimentally (as in the case of an already existing construction). If load transfer, and secondary bending stresses are known, more detailed methods are applicable for fatigue life evaluation which enables a more optimal design of joints to be made in consideration of fatigue. Author (ESA)

N80-17520# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
FATIGUE BEHAVIOR OF BS 2L65 ALUMINUM ALLOY PIN-LOADED LUGS WITH INTERFERENCE-FIT BUSHES
J. E. Moon London HMSO Nov. 1977 78 p refs Supersedes RAE-TR-77177 and ARC-37872
(ARC-R/M-3835; BR69022; ISBN-011-471168-2; RAE-TR-77177; ARC-37872) Avail: NTIS HC A05/MF A01; HMSO £7.00; PHI

Cumulative fatigue damage in lugs with and without interference fit bushes is studied. Fatigue tests carried out under constant and variable amplitude loading conditions with local stress measurements made using the companion specimen method are described. The local stress measurements are discussed in relation to the large increase in life under constant amplitude associated with fitting an interference fit bush in a pin jointed lug and to the reduction in life following prestress. The application of stress measurements in sequences representing narrow band random loading for life estimations is examined. Author (ESA)

N80-17521# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
ON INTERFACING STRUCTURAL INFORMATION AND LOADING DATA IN AEROELASTIC ANALYSIS
Dorothy Holford and J. C. Copley London HMSO May 1977 86 p refs Supersedes RAE-TR-77-074; ARC-37619
(ARC-R/M-3833; ISBN-0-11-471166-6; BR68824; RAE-TR-77-074; ARC-37619) Avail: NTIS HC A05/MF A01; HSMO £8.00; PHI

A systematic means of interfacing structural and loading information in aeroelastic analyses is developed and a computer implementation, with particular application to plate-like structures, is described. Various numerical examples of the use of the method are given, and the overall accuracy of the procedure advocated is critically examined. The proposed FORTRAN subroutine produces a flexibility matrix which purports to relate either displacement or a spatial derivative of displacement at a set of points to loads at a second set of points. Results show that so long as the displacements, as calculated from the derived matrix, do not resemble those of an eigenvector of that matrix which is associated with a relatively low flexibility (viewed in relation to the number and distribution of points in the two sets) then they are likely to be of an acceptable accuracy. Author (ESA)

N80-17522# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
FATIGUE BEHAVIOR OF PIN-LOADED LUGS IN BS 2L65 ALUMINUM ALLOY
J. E. Moon and P. R. Edwards London HMSO Nov. 1977 56 p refs Supersedes RAE-TR-77-167; ARC-37840
(ARC-R/M-3834; ISBN-0-11-471167-4; BR68825; RAE-TR-77-167; ARC-37840) Avail: NTIS HC A04/MF A01; HMSO £6.00; PHI

Fatigue tests were carried out on lugs of BS 2L65 aluminum alloy loaded by steel pins under constant amplitude (CA) and narrow band random (NBR) loading over a range of mean stresses and for different values of prestress. Life estimations for the NBR tests were made using Miner's rule. The relative fatigue performance under CA and NBR loading as expressed by the Miner summation was consistent with the fatigue damage accumulation being markedly affected by observed changes in residual stress at the point of crack initiation due to local yielding under the higher load levels. Author (ESA)

N80-17523# National Physical Lab., Teddington (England). Div. of Materials Applications.
INFLUENCE OF MONITORING CONDITIONS ON THE STRESS WAVE EMISSION DATA RECORDED DURING TENSILE TESTING OF A GRP
G. D. Sims and D. G. Gladman Jun. 1979 33 p refs
(NPL-DMA(R)5) Avail: NTIS HC A03/MF A01

A stress wave/acoustic emission monitoring technique was assessed for its potential in detecting failures in reinforced plastics. Repeat tensile tests were conducted using a standardized procedure for a glass fiber/epoxy laminate of low variability for several monitoring parameters such as system gain, transducer type, transducer to failure site separation distance, specimen dimensions, ringdown versus event, and total count versus count rate. Under most conditions a similar trend of emission data with increased applied stress was obtained. In some cases only the final failure was detected and in all cases there was a considerable variation in the absolute count levels recorded. It was found in several cases that simple empirical relationships could be obtained which allowed for these changes in the monitoring condition. However, the potential dangers in accepting data without undertaking calibration-type experiments and without directly relating the emission data to actual failures were clearly apparent. In particular, there is a need to establish that an absence of emissions is in reality an absence of failures. Author (ESA)

N80-17524# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Sect. Construction Metallique.
EXTERNAL LOADINGS ON NOZZLES IN CYLINDRICAL SHELLS Progress Report
Joris Decock Jun. 1979 52 p refs
(CRIF-MT-132; PR-3) Avail: NTIS HC A04/MF A01

The influence of the parameters t/T and D/T on the stresses in the cylindrical shell and the nozzle was examined using elastic stress measurements performed on four test models. The maximum stress in the nozzle was estimated for three different types of external loads. Fatigue tests were performed under external fully reversed longitudinal moments and the results were compared to predicted fatigue life. Author (ESA)

N80-17250 Martin Marietta Corp., Denver, Colo.
FORCE APPORTIONING FOR MODAL VIBRATION TESTING USING INCOMPLETE EXCITATION
G. Morosow and R. S. Ayre (Colorado Univ., Boulder) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 39-48 (For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17251 Virginia Polytechnic Inst. and State Univ., Blacksburg.
ON THE DISTRIBUTION OF SHAKER FORCES IN MULTI-PLE-SHAKER MODAL TESTING
W. L. Hallauer, Jr. and J. F. Stafford *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 49-63 (For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17252* Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
MODAL CONFIDENCE FACTOR IN VIBRATION TESTING
Sam R. Ibrahim *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 65-75 (For primary document see N80-17247 08-31)
(Grant NsG-1459)
Avail: NRL, Tech. Inform. Div., Washington, D.C. CSCL 20K

N80-17253 Institut National des Sciences Appliquees de Lyon, Villeurbanne (France).
A BUILDING BLOCK APPROACH TO THE DYNAMIC BEHAVIOR OF COMPLEX STRUCTURES USING EXPERIMENTAL AND ANALYTICAL MODAL MODELING TECHNIQUES
J. C. Cromer, M. Lalanne, D. Bonnecase, and L. Gaudriot *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 77-91 refs (For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17255 Martin Marietta Corp., Denver, Colo.
LOAD TRANSFORMATION DEVELOPMENT CONSISTENT WITH MODAL SYNTHESIS TECHNIQUES
R. F. Hruda and P. J. Jones *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 103-109 (For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17256 Westinghouse Research and Development Center, Pittsburgh, Pa.
REDUCED SYSTEM MODELS USING MODAL OSCILLATORS FOR SUBSYSTEMS (RATIONALLY NORMALIZED MODES)
F. H. Wolff and A. J. Molnar *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 111-118 refs (For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17259 Air Force Materials Lab., Wright-Patterson AFB, Ohio.
SPECIFICATION OF DAMPING MATERIAL PERFORMANCE
David I. G. Jones and J. P. Henderson *In* The Shock and Vibration Inform Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 1-11 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17260 Air Force Materials Lab., Wright-Patterson AFB, Ohio.
A REDUCED-TEMPERATURE NOMOGRAM FOR CHARACTERIZATION OF DAMPING MATERIAL BEHAVIOR
David I. G. Jones *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 13-22 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17261 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
COMPUTERIZED PROCESSING AND EMPIRICAL REPRESENTATION OF VISCOELASTIC MATERIAL PROPERTY DATA AND PRELIMINARY CONSTRAINED LAYER DAMPING TREATMENT DESIGN
Lynn C. Rogers and Ahid D. Nashif (Anatrol Corp., Cincinnati, Ohio) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 23-37 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17262 Lord Kinematics, Erie, Pa.
NEW STRUCTURAL DAMPING TECHNIQUE FOR VIBRATION CONTROL
B. M. Patel, G. E. Warnaka, and D. J. Mead (Southampton Univ., England) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 39-52 (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17264 Army Engineer Waterways Experiment Station, Vicksburg, Miss.
RESPONSE OF A HELICAL SPRING CONSIDERING HYSTERETIC AND VISCOUS DAMPING
P. F. Mlakar and R. E. Walker *In* the Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 63-74 (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington DC.

N80-17269 New Mexico State Univ., Las Cruces. Physical Science Lab.
FREQUENCY RESPONSE AND DIFFERENTIATION REQUIREMENTS FOR IMPACT MEASUREMENTS
Anthony S. Hu and Iian-Tau Chen *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 123-130 refs (For primary document see N80-17258 08-31) (Contract DOT-HS-6-01400)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17270 SRI International Corp., Menlo Park, Calif.
STRUCTURAL RESPONSE OF EARTH PENETRATORS IN ANGLE-OF-ATTACK IMPACTS
J. D. Colton *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 131-141 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17272 Franklin Inst. Research Labs., Philadelphia, Pa.
TESTING PIPING CONSTRAINT ENERGY ABSORBERS FOR REACTOR CONTAINMENT APPLICATIONS
R. C. Yaeger and R. C. Chou *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 161-181 ref (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17274 Agbabian Associates, El Segundo, Calif.
IMPEDANCE TECHNIQUES FOR SCALING AND FOR PREDICTING STRUCTURE RESPONSE TO AIR BLAST
F. B. Safford, R. E. Walker (Army Waterways Experiment Station, Vicksburg, Miss.), and T. E. Kennedy (Defense Nuclear Agency, Washington, D.C.) *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 2 Sep. 1978 p 193-214 refs (For primary document see N80-17258 08-31)
Avail: NRL, Tech. Inform. Div., Washington D.C.

N80-17276 Washington Univ., St. Louis, Mo. Dept. of Civil Engineering.
A SOURCE OF LARGE ERRORS IN CALCULATING SYSTEM FREQUENCIES
Robert M. Mains *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 1-4 (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17277 Paris Univ. (France). Lab. de Mecanique Appliquee.
RESEARCH METHOD OF THE EIGENMODES AND GENERALIZED ELEMENTS OF A LINEAR MECHANICAL STRUCTURE
R. Fillod and J. Diranda *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 5-12 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17282 Waterloo Univ. (Ontario). Dept. of Civil Engineering.
BUCKLING OF EULER'S ROD IN THE PRESENCE OF ERGODIC RANDOM DAMPING
H. H. E. Leipholz *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 49-52 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17284 Shock and Vibration Information Center (Defense), Washington, D. C.
RESPONSE TO MOVING LOADS OVER A CRYSTALLINE HALF-SPACE
Sasadhar De (Old Engineering Office, West Bengal, India) *In its* The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 63-70 refs (For primary document see N80-17275 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-17286 Kobe Univ. (Japan).
FIRST-PASSAGE FAILURE PROBABILITY IN RANDOM VIBRATION OF STRUCTURES WITH RANDOM PROPERTIES
N. Nakagawa, R. Kawai, and K. Funahashi *In* Shock and Vibration

Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 83-92 refs Prepared in cooperation with Kawasaki Heavy Industries, Ltd., Japan (For primary document see N80-17275 08-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

N80-17287 General Electric Co., Utica, N. Y. Aircraft Equipment Div.
FRACTURE MECHANICS APPLIED TO STEP-STRESS FATIGUE UNDER SINE/RANDOM VIBRATION
Ronald G. Lambert *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1978 p 93-101 refs (For primary document see N80-17275 08-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

N80-17301*# McDonnell Aircraft Co., St. Louis, Mo.
COMBINED VIBRATION/TEMPERATURE/SIDELOAD ENVIRONMENTAL TESTING OF UHF BLADE ANTENNAS
Ronald Volker *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 3 Sep. 1979 p 79-84 (For primary document see N80-17293 08-31)
Avail: NTIS HC A05/MF A01 CSCL 20K

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography.*

N80-17525 Colorado State Univ., Fort Collins.
ASPECTS OF DEGRADATION OF ALLUVIAL STREAMS IN RESPONSE TO BASE-LEVEL LOWERING Ph.D. Thesis
Zeev Binyamin Begin 1979 257 p
Avail: Univ. Microfilms Order No. 7928505

In homogenous alluvial sediments, not subject to armouring, the ultimate result of base level lowering by a certain amount is degradation all along the channel by the same amount. The main impact of erosion is felt in early stages after initiation of the process, and mainly near the mouth. The rate of degradation at any station along the channel reaches a peak and then slowly decreases with time, and the peak rate is attenuated with distance from the outlet. Sediment discharge at the outlet decreases rapidly with time, with a decay close to an exponential one with an exponent of about -0.5. Headward migration of knickpoints is a function of the ability of the channel to transport sediments downstream of the receding knickpoint. The exact migration pattern depends upon the shape of the knickpoint - a vertical one being described by an equation of motion different from a non-vertical, flattening knickpoint. Dissert. Abstr.

N80-17526 Colorado State Univ., Fort Collins.
ANALYTICAL/NUMERICAL METHODS FOR GROUNDWATER FLOW AND QUALITY PROBLEMS Ph.D. Thesis
Charles Joseph Daly 1979 178 p
Avail: Univ. Microfilms Order No. 7928512

The movement of dissolved substances through non homogeneous porous media is calculated by first obtaining an analytical solution to the equation of groundwater flow. This solution is then incorporated in a numerical algorithm for determining mass transport. The solution of several steady and unsteady groundwater flow problems demonstrate that the technique has the potential for high accuracy and computational efficiency. Application of the method of characteristics to the mass transport problem yields a set of differential equations whose solution is a set of characteristic lines. A fourth-order Runge-Kutta algorithm followed by a predictor-corrector scheme of the same order are used to numerically determine these lines. The aggregate of the characteristic lines defines the change of mass concentration and the path of fluid particles in the flow field. Solutions for mass transport in steady and unsteady flow fields are presented. Dissert. Abstr.

N80-17527*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARISON OF MAGNETIC ANOMALIES OF LITHOSPHERIC ORIGIN MEASURED BY SATELLITE AND AIRBORNE MAGNETOMETERS OVER WESTERN CANADA
R. A. Langel, R. L. Coles (Dept. of Energy, Mines and Resources, Ottawa), and M. A. Mayhew (Business and Technological Systems, Inc., Seabrook, Md.) Sep. 1979 39 p refs
(NASA-TM-80568) Avail: NTIS HC A03/MF A01 CSCL 08G

Crustal magnetic anomaly data from the OGO 2, 4 and 6 (Pogo) satellites are compared with upward-continued aeromagnetic data between 50 deg -85 deg N latitude and 220 deg - 260 deg E longitude. Agreement is good both in anomaly location and in amplitude, giving confidence that it is possible to proceed with the derivation and interpretation of satellite anomaly maps in all parts of the globe. The data contain a magnetic high over the Alpha ridge suggesting continental composition and a magnetic low over the southern Canada basin and northern Canadian Arctic islands (Sverdrup basin). The low in the Sverdrup basin corresponds to a region of high heat flow, suggesting a shallow Curie isotherm. A ridge of high field, with two distinct peaks in amplitude, is found over the northern portion of the platform deposits and a relative high is located in the central portion of the Churchill province. No features are present to indicate a magnetic boundary between Slave and Bear provinces, but a trend change is evident between Slave and Churchill provinces. South of 60 deg latitude a broad magnetic low is located over very thick (40-50 km) crust, interpreted to be a region of low magnetization. Author

N80-17528*# Purdue Univ., Lafayette, Ind.
ATLAS OF SOIL REFLECTANCE PROPERTIES
E. R. Stoner, M. F. Baumgardner, L. L. Biehl, and B. F. Robinson 15 Nov. 1979 89 p refs
(Contract NAS9-15466)
(NASA-CR-160446; LARS-TR-111579) Avail: NTIS HC A05/MF A01 CSCL 08M

A compendium of soil spectral reflectance curves together with soil test results and site information is presented in an abbreviated manner listing those soil properties most important in influencing soil reflectance. Results are presented for 251 soils from 39 states and Brazil. A narrative key describes relationships between soil parameters and reflectance curves. All soils are classified according to the U.S. soil taxonomy and soil series name for ease of identification. Author

N80-17529# Recognition Systems, Inc., Van Nuys, Calif.
FEASIBILITY OF USING OPTICAL POWER SPECTRUM ANALYSIS TECHNIQUES FOR AUTOMATIC FEATURE CLASSIFICATION FROM HIGH RESOLUTION THERMAL, RADAR, AND PANCHROMATIC IMAGERY
Harvey L. Kasdan 1 Jun. 1979 195 p refs
(Contract DAAK70-78-C-0019)
(AD-A076566; KS-77-370; MS-79-404; ETL-0186) Avail: NTIS HC A09/MF A01 CSCL 05/8

The objective of this study was to determine experimentally the feasibility of using optical power spectrum analysis techniques for automatic topographic feature classification from high resolution radar, panchromatic and thermal imagery. A data base of radar, panchromatic and thermal imagery was assembled. Radar and panchromatic imagery were available over the same geographical area with the same scale and perspective. An optical power spectrum data base of 6,216 individual aperture samples from the three types of imagery was collected. Feature analysis and decision software required in addition to standard FACEL routines was developed. Using this software, features and a decision rule were developed for radar imagery that achieved 90% correct classification of four classes of terrain. A quantitative statistical analysis was performed to determine the effects of aperture and sensor type on the optical power spectrum based features. In addition, a qualitative analysis was performed in order to present examples that illustrate signature differences between radar and panchromatic imagery. No single sensor performs best for all classes. The results lead to the following choices for the detection of particular terrain types: Urban-panchromatic, Water radar or panchromatic, Agriculture - radar, and Forest -thermal or radar. GRA

N80-17530# Durham Univ. (England). Dept. of Geography.
STATISTICAL CHARACTERIZATION OF ALTITUDE MATRICES BY COMPUTER. REPORT 6: AN INTEGRATED SYSTEM OF TERRAIN ANALYSIS AND SLOPE MAPPING Final Report
Ian S. Evans 1979 199 p refs
(Contract DA-ERO-591-73-G0040)
(AD-A076558) Avail: NTIS HC A05/MF A01 CSCL 08/2

A system is described which: (a) replaces existing sets of diverse terrain indices with a group of statistics for point-characteristics; (b) calculates all of these statistics in a single computer run from a single data set; and (c) utilizes available altitude matrix data. The procedures are applicable to Altitude matrix data at any grid mesh. From altitudes in each 3 x 3 submatrix, a quadratic surface is fitted and solved for its first and second horizontal and vertical derivatives at the central point. This yields the slope gradient, slope aspect, profile convexity, and plan convexity at every point in the original matrix, except for the peripheral rows and columns. These 'point' descriptors are presented as: (1) line-printer shaded maps; (2) histograms; (3) scatter plots of each pair; (4) matrix of pair-wise correlations, plus circular regressions on aspect, and several multiple regressions, and (5) summary (moment-based) statistics. In general, the five basic descriptors have little relation to each-other, except that gradient is usually a quadratic function of altitude. A comparison is made with other approaches, such as spectral analysis and fractional modelling. The long-distance persistence properties of terrain mean that considerable extra variance at long wavelengths is usually incorporated when the study area is extended. Hence the auto correlation function varies with the length of series or size of area. Variance of derivatives are also affected, but means, skews, and kurtoses are not. GRA

N80-17531# Bayerische Akademie der Wissenschaften, Munich (West Germany). Bayerischen Kommission fuer die Internationale Erdmessung.
THE WESTERN EUROPEAN SATELLITE PROGRAM Final Report
Walter Ehmsperger 1978 175 p refs In ENGLISH; GERMAN summary
(Astron-Geodaet-Arb-37; ISBN-3-7696-9780-4;
ISSN-0340-7691) Avail: NTIS HC A08/MF A01

The organization and results of the "Western European Satellite Triangulation" program are presented. The 40 participating stations and the cameras used are described. Cooperation between the prediction center is reported. The two principle models, the method of simultaneous points and the method of spatial smoothing of the orbit, are introduced and their respective formulas are derived and explained. It is shown that the calculation of simultaneous points has the advantage of being easy to carry out. For both models adequate methods were found for handling the large amount of data, eliminating erroneous measurements, and estimating individual weights for the stations. The data as submitted to the computing center did not contain the correlations between the satellite stations, and, consequently, they were not available for the calculations. The three dimensional coordinates of 30 Western European Satellite stations are computed and compared based on various model variations. Author (ESA)

N80-17532# Royal Netherlands Meteorological Inst., De Bilt.
A STOMATAL VAPOR TRANSPORT RESISTANCE METER FOR ESTIMATING BULK CROP EVAPOTRANSPIRATION [EEN STOMATAIRE WEERSTANDSMETER]
W. Kohsiek 1979 61 p refs In DUTCH; ENGLISH summary
(KNMI-WR-79-10) Avail: NTIS HC A04/MF A01

A method for measuring the bulk stomatal resistance of a surface covered with short grass is described. The principal of operation is that of a chamber method, which is a frequently used device for measuring the gas transfer across the crop atmosphere interface. An estimate for the resistance to water vapor transport between the stomatal chambers in the leaves as well as the atmosphere of the measuring device was obtained. This resistance is seen as the sum of the bulk stomatal resistance of the crop under the chamber and the resistance for the transport from the surface of the leaves to the chamber atmosphere. Results for an open and closed chamber method were compared with each other and with the bulk stomatal resistance derived from field measurements of the evaporation with Bowen's ratio, together with a model for transport resistances in the natural atmosphere. Author (ESA)

N80-17533# Royal Netherlands Meteorological Inst., De Bilt.
THE COMPUTATION OF THE VERTICAL GROUND WATER VELOCITY FROM THE GROUND TEMPERATURE PROFILE [BEREKENEN VAN DE VERTICALE GRONDWATERSNELHEID UIT GROUNDTEMPERATUURPROFIELMETINGEN]
T. DeCrook 1979 37 p refs In DUTCH; ENGLISH summary
(KNMI-WR-79-11) Avail: NTIS HC A03/MF A01

A method is described for measuring the vertical ground water velocity indirectly from the Earth's temperature profiles. If there is no ground water velocity, the ground temperature is determined by a vertical upward thermal flow, that comes from deeper bottom layers, and a thermal flow streaming up or down in the upper bottom layers which is driven by the radiation of the sun. These two heat flows determine the normal temperature profile. If the ground water streams upward, with a certain velocity, the normal temperature profile is modified. Extra heat is transported upward and the temperature increases. The rate of temperature rise depends on the velocity of water. This problem is stated as a linear partial differential equation of the second order which determines the relationship between the ground water velocity and the temperature of the bottom layers. A computer program for these calculations, written for the Burroughs B6700 in extended ALGOL language, is described. Author (ESA)

N80-17534# Geological Survey, Reston, Va.
STRATIGRAPHIC AND HYDROGEOLOGIC FRAMEWORK OF PART OF THE COASTAL PLAIN OF TEXAS
E. T. Baker, Jr. Jul. 1979 52 p refs Prepared for Texas Water Development Board, Austin
(PB-299916/7; TDWR/R-236) Avail: NTIS HC A04/MF A01 CSCL 08G

The subsurface delineation of hydrogeologic units of Miocene and younger age and stratigraphic units of Paleocene to Holocene age establishes an interrelationship of these units statewide across much of the coastal plain of Texas. The 11 dip sections and strike section, which extend from the land surface to 7,600 feet (2,316 meters) below sea level, provide continuity of correlation from the outcrop to the relatively deep subsurface. Sand containing water with less than 3,000 milligrams per liter of dissolved solids, which is shown on the sections, serves an index of water availability of this quality. GRA

N80-17535*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SEASAT GULF OF ALASKA WORKSHOP REPORT. VOLUME 1: PANEL REPORTS
Apr. 1979 374 p refs Workshop held at Pasadena, Calif., 22 Sep. 1979; sponsored in part by NASA Sponsored by NASA
(NASA-CR-162759; PB-300413/2; NOAA-79073114;
Rept-622-101) Avail: NTIS HC A16/MF A01 CSCL 08E

The comparison of surface observations with satellite sensor data as well as the intercomparison of data from sensors measuring common geophysical parameters were covered. There is clear evidence that a real time oceanic monitoring system, patterned after the Seasat sensors, yield extremely important data for meteorology, climatology, ocean circulation, navigation, and numerous other oceanographic and geodetic applications. The salient conclusions are given, on a sensor by sensor basis. GRA

N80-17536# Continental Shelf Associates, Tequesta, Fla.
SOUTH ATLANTIC HARD BOTTOM STUDY Final Report
Jun. 1979 375 p refs Original contains color illustrations
(Contract DI-AA551-CT8-25)
(PB-300821/6; BLM/YM/ES-79-13) Avail: NTIS

HC A16/MF A01 CSCL 13B

Oil and gas lease blocks in the Georgia Embayment were surveyed with a precision depth recorder, side scan sonar, and subbottom profiler for the purpose of identifying and mapping areas of hard bottom. The efficacy with which standard geophysical equipment and techniques could identify and map hard bottom stress was determined. In addition, the hard bottom substrate and associated fauna were identified and described from dredge samples and color photographs. J.M.S.

N80-17537# Manhattan Coll., New York.
VERIFICATION ANALYSIS OF LAKE ONTARIO AND ROCHESTER EMBAYMENT THREE DIMENSIONAL EUTROPHICATION MODELS Final Report
Robert V. Thomann Aug. 1979 153 p refs
(Grant EPA-R-803680030)
(PB80-103625; EPA-600/3-79-094) Avail: NTIS
HC A08/MF A01 CSCL 13B

A three dimensional time variable model of the phytoplankton and nutrients of Lake Ontario and the Rochester Embayment is examined. The data from the International Field Year on the Great Lakes (IFYGL) are used as the primary data base. The data are summarized and statistically analyzed on a three dimensional grid and segment averages using a 67 segment representation of the lake and a 72 segment representation of Rochester Embayment, are calculated. In addition, averages for eight regions of the lake and lakewise averages for two depth layers are computed. GRA

N80-17538# Texas Water Development Board, Austin.
SUSPENDED-SEDIMENT LOAD OF TEXAS STREAMS *Progress Report, Oct. 1971 - Sep. 1975*
John P. Dougherty May 1979 91 p
(PB80-101850; TDWR/R-233) Avail: NTIS
HC A05/MF A01 CSCL 08H

Sediment data obtained for the 1972 through 1975 water years are presented. Maximum, minimum, and average annual suspended-sediment loads are summarized in table form for each gage point. Sediment outflow measurements for four reservoirs in Texas are also presented. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-17539 Miami Univ., Coral Gables, Fla.
INFORMATION THEORY APPLIED TO SOLAR RADIATION CONCENTRATORS *Ph.D. Thesis*
Russell Paul Patera 1979 179 p
Avail: Univ. Microfilms Order No. 8001674

A solar collector is treated as a communication channel with the input being the directional distribution of radiation at the aperture and the output being the spatial distribution of the radiation at the absorber. The channel structure and information measure are found. The information measure is used to obtain a general figure of merit which is useful for collector comparisons over wide ranges of operating conditions. The findings of the theory indicate that for an isotropic distribution of radiation at the input, a single absorber segment is sufficient for optimum collector performance. For a nonisotropic distribution, many thermally separated absorber segments are necessary for optimum performance. The heat transfer fluid is first passed through the warm segments, and then passed sequentially through the progressively hotter segments. Three practical examples are given. Dissert. Abstr.

N80-17540 Ohio State Univ., Columbus.
INFLUENCE OF OXYGEN ON THE ELECTROCHEMICAL BEHAVIOR OF THE CaF2 SOLID ELECTROLYTE Ph.D. Thesis
Schiao-Feng Chou 1979 256 p
Avail: Univ. Microfilms Order No. 8001708

The open-circuit electromotive force (EMF) values of this cell were the same as those measured by traditional oxygen concentration cell using calcia-stabilized ZrO2 as the electrolyte. Alternating current analysis technique was used to differentiate the electrochemical behavior of CaF2 in argon and oxygen atmospheres. The equivalent circuits of cell Pt/CaF2/Pt in argon and oxygen atmospheres at different temperatures were identified. The interface conductivity measuring the rate of the electrode reaction increases when the oxygen activity in the electrode increases. The electrode reaction involves oxygen. The electrode reaction of the CaF2 cell in an oxygen environment involves oxygen. Oxygen ions are mobile in the CaF2 electrolyte. A theory is given to interpret the observed EMF of this type of oxygen concentration cell. Dissert. Abstr.

N80-17541 Georgia Inst. of Tech., Atlanta.
OPTICAL AND THERMAL EFFECTS IN LINEAR SOLAR CONCENTRATING COLLECTORS Ph.D. Thesis
Sheldon Moseley Jeter 1979 430 p
Avail: Univ. Microfilms Order No. 8000828

Procedures for the analysis and evaluation of optical and thermal effects in concentrating solar collectors employing reflector optical systems are presented. Particular emphasis is placed on the consideration of cylindrical, single-axis suntracking concentrators and collectors. The optical analysis is based on fundamental concepts of geometrical optics augmented by limited simplifications generally applicable to solar energy utilization and leading to representations of the source as a finite disc emitter and of the concentrating surface as an array of differential reflective elements. The optical characteristics of several ideal concentrators are evaluated and detailed. Coupling the results of the optical analysis with standard heat transfer and hydraulic analysis yields a model for the thermal collector suitable for performance projections and dynamic simulations. Elementary examples of the application of the model are presented. Dissert. Abstr.

N80-17542 California Univ., Berkeley.
***HEAT AND MASS TRANSFER ANALYSIS OF SOLAR-HEATED HYDROPONIC GREENHOUSES* Ph.D. Thesis**
John Charles Glaub 1979 110 p
Avail: Univ. Microfilms Order No. 8000355

An alternative greenhouse heating system was investigated in response to excessively high fuel costs currently facing greenhouse growers. A solar-heated hydroponic system was proposed and analyzed. This system utilizes the hydroponic gravel beds and nutrient solution as the thermal storage medium. Simulation results indicated a significant advantage in using double polyethylene wall construction in comparison to a single glass wall. An existing glass house can be improved by adding a single layer of plastic with an enclosed air space between. Results show a preference for placing the plastic on the inside of the house as opposed to the outside. Collector areas can be held down by increasing the thermal storage capacity of the system. A full-floor bed design offers the advantages of increased thermal storage and improved heating performance at a relatively small additional cost. Dissert. Abstr.

N80-17543*# *Electro-Mechanical Research, Inc., Sarasota, Fla.*
DOE/NASA WIND TURBINE DATA ACQUISITION. PART 1: EQUIPMENT
O. J. Strock Jan. 1980 56 p
(Contract DEN3-98)
(NASA-CR-159779; EMR-827053) Avail: NTIS
HC A04/MF A01 CSCL 10B

Large quantities of data were collected, stored, and analyzed in connection with research and development programs on wind turbines. The hardware configuration of the wind energy remote data acquisition system is described along with its use on the NASA/DOE Wind Energy Program. R.C.T.

N80-17544*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SOLAR ENERGY CONTROL SYSTEM **Patent Application**

James R. Currie, inventor (to NASA) Filed 29 Nov. 1979
18 p
(NASA-Case-MFS-25287-1; US-Patent-Appl-SN-098570) Avail: *NTIS HC A02/MF A01 CSCL 10A*

A solar energy control system for a hot air type solar energy heating system wherein thermocouples are arranged to sense the temperature of a solar collector, a space to be heated, and a top and bottom of a heat storage unit is described. Pertinent thermocouples are differentially connected togther, and these are employed to effect the operation of dampers, a fan, and an auxiliary heat source. In accomplishing this, the differential outputs from the thermocouples are amplified by a single amplifier by multiplexing techniques. Additionally, the amplifier is corrected as to offset by including as one multiplex channel a common reference signal. NASA

N80-17545*# National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.

ENERGY FROM AQUATIC PLANT WASTEWATER TREATMENT SYSTEMS

B. C. Wolverton and Rebecca C. McDonald Sep. 1979 18 p refs
(NASA-TM-X-72733) Avail: NTIS HC A02/MF A01 CSCL 10A

Water hyacinth (Eichhornia crassipes), duckweed (Spirodela sp. and Lemma sp.), water pennywort (Hydrocotyle ranunculoides), and kudzu (Pueraria lobata) were anaerobically fermented using an anaerobic filter technique that reduced the total digestion time from 90 days to an average of 23 days and produced 0.14-0.28 cu m CH4/kg (dry weight) (2.3-4.5 cu ft/lb) from mature filters. The anaerobic filter provided a large surface area for the anaerobic bacteria to establish and maintain an optimum balance of facultative, acid-forming, and methane-producing bacteria. Consequently the efficiency of the process was greatly improved over prior batch fermentations. Author

N80-17546*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

PEP SOLAR ARRAY DEFINITION STUDY **Final Technical Report**

31 Dec. 1979 138 p refs
(Contract NAS9-15870)
(NASA-CR-160457; TRW-35515-6001-RU-00) Avail: NTIS HC A07/MF A01 CSCL 10A

The conceptual design of a large, flexible, lightweight solar array is presented focusing on a solar array overview assessment, solar array blanket definition, structural-mechanical systems definition, and launch/reentry blanket protection features. The overview assessment includes a requirements and constraints review, the thermal environment assessment on the design selection, an evaluation of blanket integration sequence, a conceptual blanket/harness design, and a hot spot analysis considering the effects of shadowing and cell failures on overall array reliability. The solar array blanket definition includes the substrate design, hinge designs and blanket/harness flexibility assessment. The structural/mechanical systems definition includes an overall loads and deflection assessment, a frequency analysis of the deployed assembly, a components weights estimate, design of the blanket housing and tensioning mechanism. The launch/reentry blanket protection task includes assessment of solar cell/cover glass cushioning concepts during ascent and reentry flight condition. M.G.

N80-17547*# Institute of Gas Technology, Chicago, Ill.

HIGH-TEMPERATURE MOLTEN SALT THERMAL ENERGY STORAGE SYSTEMS **Final Report, 14 Sep. 1977 - 14 Dec. 1978**

Randy J. Petri, Terry D. Claar, Ray R. Tison, and Leonard G. Marianowski Feb. 1980 175 p refs
(Contract NAS3-20806)
(NASA-CR-159663; DOE/NASA/0806-79/1) Avail: NTIS HC A08/MF A01 CSCL 10A

The results of comparative screening studies of candidate molten carbonate salts as phase change materials (PCM) for advanced solar thermal energy storage applications at 540 to 870 C (1004 to 1600 F) and steam Rankine electric generation at 400 to 540 C (752 to 1004 F) are presented. Alkali carbonates are attractive as latent heat storage materials because of their relatively high storage capacity and thermal conductivity, low corrosivity, moderate cost, and safe and simple handling requirements. Salts were tested in 0.1 kWhr lab scale modules and evaluated on the basis of discharge heat flux, solidification temperature range, thermal cycling stability, and compatibility with containment materials. The feasibility of using a distributed network of high conductivity material to increase the heat flux through the layer of solidified salt was evaluated. The thermal performance of an 8 kWhr thermal energy storage (TES) module containing LiKCO3 remained very stable throughout 5650 hours and 130 charge/discharge cycles at 480 to 535 C (896 to 995 F). A TES utilization concept of an electrical generation peaking subsystem composed of a multistage condensing steam turbine and a TES subsystem with a separate power conversion loop was defined. Conceptual designs for a 100 MW sub e TES peaking system providing steam at 316 C, 427 C, and 454 C (600 F, 800 F, and 850 F) at 3.79 million Pa (550 psia) were developed and evaluated. Areas requiring further investigation have also been identified. Author

N80-17548*# Kaman Aerospace Corp., Bloomfield, Conn.

DESIGN, FABRICATION, TEST, AND EVALUATION OF A PROTOTYPE 150-FOOT LONG COMPOSITE WIND TURBINE BLADE **Final Report**

Herbert W. Gewehr Sep. 1979 135 p refs
(Contracts NAS3-20600; EX-76-I-01-1028)
(NASA-CR-159775; DOE/NASA/0600-79/1; R-1575) Avail: NTIS HC A07/MF A01 CSCL 10B

The design, fabrication, testing, and evaluation of a prototype 150 foot long composite wind turbine blade is described. The design approach and material selection, compatible with low cost fabrication methods and objectives, are highlighted. The operating characteristics of the blade during rotating and nonrotating conditions are presented. The tensile, compression, and shear properties of the blade are reported. The blade fabrication, tooling, and quality assurance are discussed. A.W.H.

N80-17549*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

PROCEEDINGS OF THE 13TH PROJECT INTEGRATION MEETING **Progress Report, Apr. 1979 - Aug. 1979**

R. R. McDonald Aug. 1979 465 p Presented at 13th Project Integration Meeting, 22-23 1979
(Contract NAS7-100)
(NASA-CR-162787; JPL-Pub-79-88; DOE/JPL-1012-29; PR-13) Avail: NTIS HC A20/MF A01 CSCL 10A

Progress made by the Low Cost Solar Array Project during the period April through August 1979 is presented. Reports are given on project analysis and integration; technology development in silicon material, large area sheet silicon, and encapsulation; production process and equipment development; engineering and operations, and a discussion of the steps taken to integrate these efforts. A report on, and copies of viewgraphs presented at the Project Integration Meeting held August 22-23, 1979 are presented. M.M.M.

N80-17550*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

CHARACTERIZATION OF SOLAR CELLS FOR SPACE APPLICATIONS. VOLUME 12: ELECTRICAL CHARACTERISTICS OF SOLAREX BSF, 2-OHM-CM, 50-MICRON SOLAR CELLS (1978 PILOT LINE) AS A FUNCTION OF INTENSITY, TEMPERATURE, AND IRRADIATION

B. E. Anspaugh, D. M. Beckert, R. G. Downing, T. F. Miyahira, and R. S. Weiss 1 Mar. 1980 44 p refs
(Contract NAS7-100)
(NASA-CR-162789; JPL-Pub-78-15-Vol-12) Avail: NTIS HC A03/MF A01 CSCL 10A

Electrical characteristics of Solarex back-surface-field, 2-ohm-cm, 50-micron N/P silicon solar cells are presented in graphical and tabular format as a function of solar illumination intensity, temperature, and irradiation. Author

N80-17551*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

CHARACTERIZATION OF DELIBERATELY NICKEL-DOPED SILICON WAFERS AND SOLAR CELLS

A. M. Salama 1 Nov. 1980 24 p refs
(Contract NAS7-100)
(NASA-CR-162790; JPL-Pub-79-116; DOE/JPL-1012-34)
Avail: NTIS HC A02/MF A01 CSCL 10A

Microstructural and electrical evaluation tests were performed on nickel-doped p-type silicon wafers before and after solar cell fabrication. The concentration levels of nickel in silicon were 5 x 10 to the 14th power, 4 x 10 to the 15th power, and 8 x 10 to the 15th power atoms/cu cm. It was found that nickel precipitated out during the growth process in all three ingots. Clumps of precipitates, some of which exhibited star shape, were present at different depths. If the clumps are distributed at depths approximately 20 micron apart and if they are larger than 10 micron in diameter, degradation occurs in solar cell electrical properties and cell conversion efficiency. The larger the size of the precipitate clump, the greater the degradation in solar cell efficiency. A large grain boundary around the cell effective area acted as a gettering center for the precipitates and impurities and caused improvement in solar cell efficiency. Details of the evaluation test results are given. Author

N80-17552*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

EVALUATION OF HIGH-ENERGY LITHIUM THIONYL CHLORIDE PRIMARY CELLS

H. A. Frank 1 Feb. 1980 99 p refs
(Contract NAS7-100)
(NASA-CR-162791; JPL-Pub-80-6) Avail: NTIS HC A05/MF A01 CSCL 10A

An advanced commercial primary lithium cell (LiSoCl2) was evaluated in order to establish baseline data for improved lithium batteries for aerospace applications. The cell tested had nominal capacity of 6 Ah. Maximum energy density at low rates (less than C/30, where C is the cell capacity in amp-hrs and 30 corresponds to a 30 hr discharge time) was found to be near 300 Wh/kg. An equation which predicts the operating voltage of these cells as a function of current and state of charge is presented. Heat generation rates of these cells were determined as a function of current in a calorimeter. It was found that heat rates could be theoretically predicted with some degree of accuracy at currents less than 1 amp or the C/6 rate. No explosions were observed in the cells during the condition of overdischarge or reversal nor during high rate discharge. It was found, however, that the cells can vent when overdischarge currents are greater than C/30 and when discharge rates are greater than 1.5C. A.R.H.

N80-17553# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.

REGENERATIVE BURNER SYSTEM FOR THERMOELECTRIC POWER SOURCES

G. Guazzoni, J. Angello, and A. Herchakowski Jul. 1979 9 p refs
(DA Proj. 1L1-62705-AH-94)
(AD-A075955; DELET-TR-79-16) Avail: NTIS HC A02/MF A01 CSCL 10/2

A thermoelectric power source is being developed to provide a multifuel, silent, maintenance free tactical power generator for forward area and unattended-operation applications. An experimental study of a regenerative burner system for the 500-Watt Thermoelectric Power Source has resulted in significant reduction in fuel consumption and infrared signature of the power source. GRA

N80-17554# KDI Score, Inc., Cockeysville, Md.

IMPROVED THERMAL BATTERY Final Report, Jun. 1976 - Dec. 1978

Praful V. Dand and Khushrow K. Press Apr. 1979 38 p
(Contract F33615-76-C-2144; AF Proj. 3145)
(AD-A075835; AFAPL-TR-79-2027) Avail: NTIS HC A03/MF A01 CSCL 10/3

Under U.S.A.F. Contract F33615-76-C-2144, KDI SCORE undertook a study to advance state-of-the-art technology of thermal batteries for military applications, so that they might meet the requirements of some systems now using more complicated and expensive reserve batteries. An exhaustive study of the calcium/calcium chromate system and investigation of many new electrochemical systems showed lithium/iron disulfide to be a superior system got thermal batteries, with longer life at high current densities, and greater energy density. Based on battery tests, it was concluded that calcium/calcium chrome thermal batteries could not achieve the goal of 30 minutes life at 30 volts and 30 amperes, and that the lithium-aluminum/iron disulfide system, which achieved approximately 80% of the goal, could, with further development reach and possibly surpass this goal. Author (GRA)

N80-17555# Brookhaven National Lab., Upton, N. Y.

THERMAL MATS FOR SPACE HEATING AND COOLING

P. P. Szydlik and A. L. Berlad Mar. 1979 19 p refs
(Contract EY-76-C-02-0016)
(BNL-51019) Avail: NTIS HC A02/MF A01

A single solar-powered device to accomplish both direct-gain heating and space cooling or water heating was studied. In the former operating mode, heating load reductions of 10 to 30 percent were achieved for small structures under cold, sunny midwinter weather conditions. With water flowing, cooling load reductions of 25 percent were obtained with the mats attached to only one large surface of similar structures. The mats also posses significant water heating capability which is a function of flow rate and solar flux. When operated simultaneously as space cooling devices, they serve as efficient water preheaters. For lower flow rates, temperature rises are sufficiently high for direct coupling to domestic hot water supplies. DOE

N80-17556# Franklin Research Center, Philadelphia, Pa.

FIRST PASSIVE SOLAR HOME AWARDS

Jan. 1979 229 p refs
(Contract EX-76-A-29-1020)
(DSE-1020-T17) Avail: NTIS HC A11/MF A01

One hundred and sixty two solar home projects are listed and described. The projects are divided into three general categories: direct solar gain, indirect solar gain, and solarium. Discussions on selecting the best type of solar project for a given area, issues involved in marketing passive solar homes, and calculating the solar gain from passive systems are included. A.W.H.

N80-17557# Bechtel National, Inc., San Francisco, Calif.

COMBINED CYCLE FOR SOLAR-FOSSIL HYBRID POWER GENERATION

E. Y. Lam and J. H. Westsik 1979 5 p refs Presented at 14th Intersoc. Energy Conversion Conf., Boston Mass., 5 Aug. 1979
(Contract ET-78-C-03-2051)
(CONF-790803-43) Avail: NTIS HC A02/MF A01

Parametric studies were conducted on a near term and an advanced version of a nominal 100 MWe commercial power system. The combined cycle hybrid system consists of an air operated open Brayton cycle with a steam Rankine bottoming cycle utilizing the gas turbine waste heat. Solar energy is used to preheat the air in the gas turbine cycle with the air cooled receiver located upstream from the combustor in a series arrangement. Cycle efficiencies of 43.5 and 47.7 percent and average annual solar fractions of .312 and .408 were predicted for the near term and advanced versions respectively. DOE

N80-17558# Idaho National Engineering Lab., Idaho Falls.

TODAY'S GEOTHERMAL POWER ECONOMICS AND RISKS

T. W. Lawford 1979 6 p refs Presented at 14th Intersoc. Energy Conversion Conf., Boston, 5 Aug. 1979
(Contract EY-76-C-07-1570)
(CONF-790803-44) Avail: NTIS HC A02/MF A01

Capital and power generation costs are developed as a parameterized composite of a number of ongoing geothermal power projects. Several of the most commonly accepted risks of geothermal power are evaluated in terms of cost penalties to a basic cost of power. The status of geothermal power in the U.S. is reviewed. DOE

N80-17559# California Univ., Berkeley. Lawrence Berkeley Lab.

SIMULATION OF THE DEPLETION OF TWO-PHASE GEOTHERMAL RESERVOIRS

K. Pruess, G. Bodvarsson, R. C. Schroeder, P. A. Witherspoon,

R. Marconcini (Ente Nazionale per l'Energia Elettrica, Florence, Italy), G. Neri (Ente Vazionale per l'Energie Electtrica, Florence, Italy), and C. Ruffilli (Ente Nazionale per l'Energia Elettrica, Florence, Italy) Aug. 1979 18 p refs Presented at 54th Ann. Tech. Conf. and Exhibition, Las Vegas, Nev., 23 Sep. 1979
(Contract W-7405-eng-48)
(LBL-9606; CONF-790913-8) Avail: NTIS HC A02/MF A01

The simulator SHAFT79 was used to study the depletion of different types of geothermal reservoirs. Investigations of idealized systems include effects of gravity and fluid injection. Pressure decline is analyzed as a function of cumulative production. The main conclusions are (1) the well-known p/Z-method for estimating fluid reserves is not applicable to two-phase geothermal reservoirs; (2) there is a strong tendency towards spatially uniform boiling which causes a pressure decline and allows in many cases, estimates of the total reservoir volume and of the total heat content of the reservoir rock; (3) propagation of a boiling front through a deep water tables, as a consequence of fluid production, gives rise to a peculiar pattern of pressure decline and may allow prediction of the distance of the water table from the producing wells and of the vertical thickness of the water zone, thereby giving important clues to estimating fluid reserves; (4) the pressure effects of injection of colder fluid depend strongly on (one- or two-) phase conditions in the reservoir, upon injection rate, and upon absolute permeability. Average pressure may actually decline in two-phase reservoirs rather than increase due to injection. DOE

N80-17560# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.

METAL FOILS FOR DIRECT APPLICATION OF ABSORBER COATINGS ON SOLAR COLLECTORS

C. M. Lampert Aug. 1979 18 p refs Presented at the Am. Electroplaters Soc. Symp. on Coatings for Solar Collectors, St. Louis, 16-17 Oct. 1979
(Contract W-7405-eng-48)
(LBL-9324; CONF-791021-1) Avail: NTIS HC A02/MF A01

The basic materials and processing associated with the production of coated metal foils for solar collector absorber surfaces are discussed. Also covered are details of heavier metal strips for direct fabrication of solar collectors. Techniques including bonding methods and the use of adhesives are surveyed. Commercial solar foil manufacturers are covered, along with the new research efforts in this area. In conclusion, advantages and disadvantages are outlined, with specific recommendations. DOE

N80-17561# Arizona Univ., Tucson. Dept. of Electrical Engineering.

SEGMENTED DISH CONCENTRATOR DESIGN PROJECT

R. L. Call Jul. 1979 89 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7024) Avail: NTIS HC A05/MF A01

A description of the segmented dish concentrator is presented in two parts: (1) the design and fabrication of the optical module concentrator with heat sink and solar cell receiver; and (2) the design and procedure of mounting the solar cells. The optical module consists of tiers of conical reflecting surfaces accumulating light on a central hexagonal shaped cylindrical receiver. The solar cells are mounted on the faces of the hexagon. Complete units were assembled and tested. Various reflecting materials were tested. An overall maximum of 7.6 percent was obtained for the module using a silver reflector. R.E.S.

N80-17562# Midwest Research Inst., Golden, Colo.

STATE-OF-THE-ART OF SOLAR CONTROL SYSTEMS IN INDUSTRIAL PROCESS HEAT APPLICATIONS

W. S. Su and J. N. Castle Jul. 1979 26 p refs Presented at the ISA Natl. Conf., Chicago, 22-25 Oct. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-39-240; CONF-791005-5) Avail: NTIS HC A02/MF A01

Solar system configurations currently being used or proposed are presented. Parameters and functions deemed essential in solar system controls are identified. Operating deficiencies and possible future improvements are discussed. DOE

N80-17563# Sandia Labs., Albuquerque, N. Mex.

SUNTECH SOLAR LINEAR ARRAY THERMAL SYSTEM (SLATS) TEST RESULTS Summary Report

H. J. Gerwin Aug. 1979 58 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0658) Avail: NTIS HC A04/MF A01

A fixed-receiver, movable-reflector solar collector system was tested. The collector included 260 sq m of reflector area. Thermal energy was transferred from the linear receiver to a heat exchanger by water and from the heat exchanger to the thermal storage tanks by Therminol 66. The collector system start-up and operation over a period of 16 months is described. Several data tables and many graphical displays show the performance characteristics under various operating parameters. DOE

N80-17564# Sandia Labs., Albuquerque, N. Mex.

RECEIVER ASSEMBLY DESIGN STUDIES FOR 2-m 90 DEG PARABOLIC-CYLINDRICAL SOLAR COLLECTORS

A. C. Ratzel Sep. 1979 87 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1026) Avail: NTIS HC A05/MF A01

A computer simulation was developed to provide cumulative all day performance results or instantaneous solar noon results for three annular solar receiver assemblies: 2.223, 2.54, and 3.175 cm o.d. tubes with concentric glass jackets. Representative clear spring, summer, and winter conditions for Albuquerque, N.M. were modeled. Design problems considered in the analysis included misalignment of the receiver assembly from the focal line, reflector trough tracking bias, variation in receiver tube operating temperature, and variation in the reflector trough one-dimensional slope errors and two-dimensional mirror errors. Summarized performance results for all studies are provided graphically. For operating receiver-tube temperatures < 475 K, the 3.175 cm receiver tube provides the best overall collector performance results. For higher operating temperatures where detrimental receiver heat losses become more significant, the smaller 2.54 cm tube is more effective for solar energy collection. DOE

N80-17565# Sandia Labs., Albuquerque, N. Mex.

PERFORMANCE OF LINEAR SOLAR CONCENTRATING COLLECTORS

R. P. Stromberg 1979 21 p refs Presented at the First Intern. Symp. on Non-conventional Energy, Trieste, Italy, 27 Aug. - 7 Sep. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1378C; CONF-790850-1) Avail: NTIS HC A02/MF A01

Performance equations and performance as a function of intensity are discussed. Progress over the past five years and current linear concentrating collector performance are reviewed. The design and development of a low technology linear concentrator are described. DOE

N80-17566# Sandia Labs., Albuquerque, N. Mex.

PERFORMANCE OF SOLAR PASSIVE BUILDINGS

R. P. Stromberg 1979 20 p refs Presented at the First Intern. Symp. on Non-conventional Energy, Trieste, Italy, 27 Aug. - 7 Sep. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1574C; CONF-790850-2) Avail: NTIS HC A02/MF A01

Test data are presented for five different homes during the same winter days. Trombe wall, waterwall, greenhouse, and direct gain features of the buildings display their differing responses to the same climate conditions. DOE

N80-17567# Battelle Pacific Northwest Labs., Richland, Wash.

GUST-RISE EXCEEDANCE STATISTICS FOR WIND TURBINE DESIGN

C. H. Huang and G. H. Fichtl Jul. 1979 31 p refs
(Contract EY-76-C-06-1830)
(PNL-2530) Avail: NTIS HC A03/MF A01

A method of obtaining the velocity change for the design life of a wind energy conversion system is presented. The turbulence spectra, variation of the length scale, turbulence intensity, and surface roughness that are needed to compute the total number of gust rises from the formula are also described. K.L.

N80-17568# Sandia Labs., Albuquerque, N. Mex.
MAGMA ENERGY RESEARCH, 79-1 Semiannual Report, Oct. 1 - 31 Mar. 1979
R. K. Traeger, ed., J. L. Colp, ed., and R. R. Neel, ed. Jul. 1979 59 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1344) Avail: NTIS HC A04/MF A01

The Kilauea Iki lava lake was evaluated. Mathematical models of the cooling of the lake and the state of solidification of the liquid lens were verified by thermal profile and permeability measurements. Jet-augmented drilling concepts successfully penetrated the viscous, multiphase molten rock region in some locations where conventional drilling failed. Heat transfer studies in the lake suggest that injection of fluids to enhance convection may be useful to extract energy from magma chamber margins. An 800 cc simulation facility for evaluating simulated magma properties at temperatures to 1500 C and pressures to 4 kbar was completed and tested. Thermodynamic stability diagrams were developed for 15 pure metals in basaltic magma systems and compatibility tests were completed. Results are to be used to define simple alloy systems which may be compatible with magmas and to identify other superalloy material candidates. DOE

N80-17569# Midwest Research Inst., Golden, Colo.
OVERVIEW OF DEVELOPING PROGRAMS IN SOLAR DESICCANT COOLING FOR RESIDENTIAL BUILDINGS
1979 18 p Presented at the ASHRAE Soc. Meeting, Detroit, 24 Jun. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-34-187; CONF-790678-3) Avail: NTIS HC A02/MF A01

Open cycle adsorption and absorption systems are examined. The different dehumidifier bed configurations are the distinguishing features of these systems. The basic operating principles of each dehumidifier concept are explained along with some discussion of their comparative features. Performance predictions developed by SERI for a solar desiccant solar system employing an axial flow desiccant wheel dehumidifier are presented. In terms of life cycle cost and displaced fossil fuel energy, the results indicate that it should be beneficial to use solar desiccant coolers in residential applications. DOE

N80-17570# Battelle Pacific Northwest Labs., Richland, Wash.
SOME POTENTIAL MATERIAL SUPPLY CONSTRAINTS IN SOLAR SYSTEMS FOR HEATING AND COOLING OF BUILDINGS AND PROCESS HEAT. A PRELIMINARY SCREENING TO IDENTIFY CRITICAL MATERIALS
R. L. Watts, W. E. Gurwell, T. A. Nelson, and S. A. Smith Jun. 1979 137 p refs
(Contract EY-76-C-06-1830)
(PNL-2972) Avail: NTIS HC A07/MF A01

Nine solar heating and cooling of buildings designs and three agricultural and industrial process heat designs were studied to identify potential future material constraints to their large scale installation and use. The systems were screened and found to be free of serious future material constraints. The screening was carried out for each individual system design assuming 500 million sq m of collector area installed by the year 2000. Also, two mixed designed scenarios, containing equal portions of each system design, were screened. Three materials were identified that could possibly restrain the deployment of solar systems in the specific scenarios investigated. They are iron and steel, soda lime glass and polyvinyl fluoride. All three of these materials are bulk materials. No raw material supply constraints were found. DOE

N80-17571# Solar Environmental Engineering Co., Inc., Fort Collins, Colo.
CONTINUING REGIONAL SOLAR ENERGY INFORMATION MINI-CENTER ACTIVITIES AND UPDATING THE SOLCOST PROGRAM Quarterly Report, Nov. 1978 - Jan. 1979
L. J. Lantz Jan. 1979 31 p
(Contract EG-77-C-02-4643)
(COO-4643-T1) Avail: NTIS HC A03/MF A01

Contents: interactive SOLCOST interface; energy conversion - solar system optimization; detailed duct sizing; extension of the SOLCOST data base; portable FORTRAN version; automatic collector parameter subroutine; the SOLAR INDEX; and the operation of the SOLCOST Mini-Center. DOE

N80-17572# Research Triangle Inst., Research Triangle Park, N. C.
DEVELOPMENT OF HIGH EFFICIENCY, LOW COST ZnSiAs2 SOLAR CELLS. Quarterly Progress Report, 9 Apr. - 30 Jun. 1979
J. E. Andrews 1979 7 p
(Contract DE-AC04-79ET-23001)
(DOE/ET-23001-T1; QPR-1) Avail: NTIS HC A02/MF A01

Three critical goals are identified that must be achieved before ZnSiAs2 can be realistically assessed: (1) hole concentrations must be reduced the 1018 to 1019/cu cm range to the 1016 to 1017/cu cm range (2) n-type ZnSiAs2 must be demonstrated; and (3) ZnSiAs2 pn junctions must be demonstrated. The approach taken and the progress made toward achieving these goals are described. DOE

N80-17573# Midwest Research Inst., Golden, Colo.
AEROSOLS AND SOLAR ENERGY
R. E. Bird and R. L. Hulstrom 1979 11 p refs Presented at the Workshop on Artificial Aerosols; Vail, Colo., 19 Jun. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-36-309; CONF-7906108-1) Avail: NTIS HC A02/MF A01

A brief description is presented of the involvement of the Solar Energy Research Institute (SERI) in atmospheric research, including aerosol characterization and modeling. The use of both rigorous and simple models for radiation transport is described. Modeled broadband solar irradiance data are shown to illustrate the important influence that aerosols have on the enrgy available to solar systems and the economics of solar systems design. Standard aerosol measurement methods for solar applications are discussed along with the need for improved instrumentation and methods. DOE

N80-17574# Battelle Pacific Northwest Labs., Richland, Wash.
ENERGY MATERIAL TRANSPORT, NOW THROUGH 2000. SYSTEM CHARACTERISTICS AND POTENTIAL PROBLEMS. TASK 3: PETROLEUM TRANSPORTATION Final Report
J. G. DeSteese Mar. 1979 291 p
(Contract EY-76-C-06-1830)
(PNL-2421) Avail: NTIS HC A13/MF A01

A summary characterization of the petroleum transportation system and an assessment of some potential problems that may impact petroleum transportation in the United States during the balance of the century are presented. The system characterization includes a review of petroleum product movements, modal operations and comparisons, and transportation regulations and safety. A median scenario based on published projections shows that the US will probably rely on foreign oil to supply between 40 and 50 percent of domestic petroleum needs throughout the balance of the century. DOE

N80-17575*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ASSESSMENT OF LOW-COST MANUFACTURING PROCESS SEQUENCES
Robert G. Chamberlain 1979 11 p refs Presented at the European Congr. on Operations Res., Amsterdam, 9 Apr. 1979
(Contract EY-76-A-29-1012)
(NASA-CR-162745; CONF-790451-1) Avail: NTIS HC A02/MF A01 CSCL 10A

An extensive research and development activity to reduce the cost of manufacturing photovoltaic solar arrays by a factor of approximately one hundred is discussed. Proposed and actual manufacturing process descriptions were compared to manufacturing costs. An overview of this methodology is presented. DOE

N80-17576# Dow Chemical Co., Midland, Mich. Hydrocarbons and Energy Research Dept.
ENERGY FROM THE SITU PROCESSING OF ANTRIM OIL SHALE Quarterly Technical Progress Report, Jan. - Mar. 1979
L. J. Washington, Jr. 20 Mar. 1979 45 p refs
(Contract EX-76-C-01-2346)
(FE-2346-44) Avail: NTIS HC A03/MF A01

The 100 series wells, which had been hydraulically and then explosively fractured, are shown to have much greater permeability than had been present in the wells on the existing site during the 1978 extraction trials. Well 301, which is the central well in the explosive underreaming series, was cleaned out. Two wells were drilled and cored nearby. Extensive fracturing due to the use of explosives in Well 301 was evident in the well located 15 feet from the site of the explosive treatment. Communication between these wells is also evident. A downhole methane burner of Tejas Petroleum Engineers was successfully tested under realistic operating conditions in an existing well. DOE

N80-17577# Wizard Research and Development Group, Inc., Washington, D.C.

CRITERIA FOR AN IDEAL SOLAR PHOTOVOLTAIC POWERED INDUSTRY

Jun. 1979 74 p refs
(Contract ET-78-X-01-5433)
(HCP/T5433-01) Avail: NTIS HC A04/MF A01

The application of solar photovoltaic energy and the use of energy in the Primary Metals Industries were surveyed in literature and used to outline criteria for an ideal solar photovoltaic powered industry. Some of the major findings include: (1) the most important requirements of an ideal solar photovoltaic powered industry are the ability to use dc electrical power, ability to be located in Southern California or the Southwestern US and ability to do without power for extended periods of time, (2) the costs of varying from the ideal are most severe with respect to the loss of power element of the criteria, (3) although most of the industries in the Primary Metals group use tremendous amounts of electrical energy, the general requirements of an uninterruptible power source makes them less than ideal users of photovoltaic energy, (4) it appears to be both technologically and económically feasible to develop processes which would make at least four of the seven members of the Primary Metals Industries ideal solar photovoltaic powered industries. DOE

N80-17578# Brookhaven National Lab., Upton, N. Y.

REGIONAL ENVIRONMENT-ENERGY DATA BOOK: NORTHEAST REGION

Dec. 1978 714 p refs
(Contract EY-76-C-02-0016)
(DOE/TIC-10114/3; BNL-24867) Avail: NTIS HC A99/MF A01

A compilation of regional data relating to the energy, environmental, socioeconomic, and institutional characteristics of the Northeast is presented. The document discusses: current and historic data on energy supply, demand, and production; sector fuel demands, fuel consumption, transmission, and transportation; location of energy production and conversion; water quality and quantity; air quality and air quality control areas; natural and induced climatic conditions; waste disposal, land and coast conditions, use, and management; managed and endangered species; demographic and socioeconomic conditions; and health and mortality data. DOE

N80-17579# Rasor Associates, Inc., Sunnyvale, Calif.

THERMIONIC CONVERTERS AND LOW-TEMPERATURE PLASMA

F. G. Baksht, G. A. Dyvzhev, A. M. Martsinovskiy, B. Ya. Moyzhes, G. Ye. Dikus, E. B. Sonin, and V. G. Yuryev 1978 489 p refs Transl. into ENGLISH of Termoemissionnye prebrazovateli i nizkotemperaturnaia plazma (USSR), 1973 490 p
(DOE-TR-1) Avail: NTIS HC A21/MF A01

The fundamental physical processes in plasma diodes (the phenomena of plasmas and electrodes surfaces), the methods for investigating the low-temperature plasma of thermionic converters, and the investigation of physical processes in thermionic converter (TIC) plasmas and pre-electrode sheaths that occur in the various operating modes are outlined. Topics covered include (1) thermionic converters and low-temperature plasma; (2) emission and adsorption processes (TIC electrodes); (3) elementary processes in a plasma; (4) kinetic phenomena in the plasma; (5) ionization and recombination in a low-temperature plasma; (6) pre-electrode phenomena in a TIC plasma; (7) experimental methods for investigating low-temperature plasmas; (8) the diffusion mode of thermionic converters; (9) the low-voltage arc in a TIC; (10) the direct-flight (Knudsen) mode of TIC operation; and (11) some engineering problems of TIC's. DOE

N80-17580# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).

THE EFFECT OF TEMPERATURE ON SILICON SOLAR CELL PERFORMANCE Final Report [EFFET DE LA TEMPERATURE SUR LE FONCTIONNEMENT DES CELLULES SOLAIRES AU SILICIUM]

S. Makram-Ebeid Feb. 1979 33 p refs In FRENCH; ENGLISH summary
(Contract DGRST-77-7-2024)
(LEP-79/202.SME-680-C) Avail: NTIS HC A03/MF A01

The effect of temperature on silicon solar cells was investigated for monocrystalline cells with P-N and MIS structures and for polycrystalline cells having N+/P structures. The I-V characteristics under AM1 conditions were measured at different temperatures. The dark current was measured and interpreted by means of known theories. A numerical model is developed to calculate the spectral response and the AM1 photocurrent. The theory is compared with experiments and it is shown that for monocrystalline cells the temperature change of photocurrent is mainly due to changes in the optical absorption coefficients. In polycrystalline cells, the increase in the lifetime of photocarriers with increasing temperature contributes significantly to change in the photocurrent. Author (ESA)

N80-17581# Institut fuer Kernenergetik, Stuttgart (West Germany). Energy Conversion and Heat Transfer Div.

TECHNICAL ASSISTANCE IN CONNECTION WITH THE ADAPTATION OF THE HEAT PIPE DIODE Final Report

M. Groll, W. D. Muenzel, and W. Supper May 1979 48 p ref
(Contract ESTEC-2943/76-NL-PP(SC))
(ESA-CR(P)-1232) Avail: NTIS HC A03/MF A01

The shutdown behavior of an all aluminum axially grooved heat pipe diode was examined. A flexible stainless steel artery heat pipe was investigated using ammonia as the working fluid. The liquid trap technique was used for the axially grooved pipe, heating the condenser, and attaching a thermal mass to both evaporator and trap. Shutdown energy of the diode was about 1.5 Wh. The flexible pipe showed a maximum performance of more than 300 W for both the straight and bent pipe.
Author (ESA)

N80-17582# Badische Anilin- und Soda-Fabrik A. G., Ludwigshafen am Rhein (West Germany).

DEVELOPMENT OF ELECTROCHEMICAL STORAGE BATTERIES WITH IMPROVED ENERGY DENSITY Final Report

Fritz Beck and Wolfram Treptow Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 209 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-77-88) Avail: NTIS HC A10/MF A01; Fachinformationzentrum, Karlsruhe, DM 43.45

The development of secondary batteries containing metals and metal oxides as nonporous electrodes was investigated. Of the systems examined Zn/MnO2 has the most favorable theoretical stored energy density (up to 360 Whr/kg). Acid corrosion of active masses and the poor load capacity of MnO2 impeded practical applications. The Pb/PbO2 system did not have these problems with an energy yield of 35 to 40 Whr for a theoretical stored energy density of 107 Whr/kg. The limiting value was about 50 Wh/kg. These values were valid for HBF4 as an electrolyte, which was found to be optimal. Power density was high as well. Results indicate that polypropylene filled with natural graphite is feasible as material for base electrodes. It leads to an essentially metal free bipolar battery design and an improved manufacturing technique. Data on cycle life as well as suggestions for the transformation of these results into improved battery design are also presented. Author (ESA)

N80-17583# Royal Aircraft Establishment, Farnborough (England). Space Dept.

PHOTOVOLTAIC CONVERSION RESEARCH AND DEVELOPMENT IN THE UNITED KINGDOM

F. C. Treble London HMSO 9 Mar. 1977 14 p refs Presented at 1st Solar Energy R and D Workshop, Bldg. Res. Estab., 24 Mar. 1977

(RAE-TM-SPACE-247; BR57075) Avail: NTIS HC A02/MF A01

Research and development, aimed at reducing the cost and increasing the efficiency of photovoltaic solar cells and modules for terrestrial applications in the United Kingdom is discussed. The cell types involved include crystalline and amorphous silicon, thin film and ceramic cadmium sulfide, cadmium sulfide/indium phosphide, gallium arsenide, and Schottky barrier. These activities are reviewed, with some background information on the general topic of photovoltaic conversion and the merits of the various approaches. Recommendations for future action are made. Author (ESA)

N80-17584# National Technical Information Service, Springfield, Va.

THERMAL ENERGY STORAGE, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Jul. 1979

Diane M. Cavagnaro Sep. 1979 117 p
(NTIS/PS-79/0952/6) Avail: NTIS HC $28.00/MF $28.00 CSCL 10C

The cited reports of Federally funded research concern thermal energy storage. The 112 citations cover the design of equipment, performance evaluation, theory, materials used, and experimental design. GRA

N80-17585# National Technical Information Service, Springfield, Va.

THERMAL ENERGY STORAGE, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1977

Diane M. Cavagnaro Sep. 1979 203 p
(NTIS/PS-79/0951/8) Avail: NTIS HC $28.00/MF $28.00 CSCL 10C

Studies on thermal energy storage are cited. The 197 citations discuss the materials used, design, theory, performance evaluation, experimental design and applications. GRA

N80-17586# National Technical Information Service, Springfield, Va.

THERMAL ENERGY STORAGE, VOLUME 1. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - 1977

Diane M. Cavagnaro Sep. 1977 211 p
(NTIS/PS-79/0953/4) Avail: NTIS HC $28.00/MF $28.00 CSCL 10C

Research from worldwide journal literature on thermal energy storage is cited in the bibliography. The 205 citations cover the materials used, equipment design, theory, industries, performance evaluation, and the problems faced. GRA

N80-17587# National Technical Information Service, Springfield, Va.

THERMAL ENERGY STORAGE, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1977 - Jul. 1979

Diane M. Cavagnaro Sep. 1979 116 p
(NTIS/PS-79/0954/2) Avail: NTIS HC $28.00/MF $28.00 CSCL 10C

Reports from worldwide research are cited covering thermal energy storage. The 110 citations cover many aspects such as the materials used, theory, applications, performance evaluation, design, and problems and advantages. GRA

N80-17588# National Technical Information Service, Springfield, Va.

SILICON SOLAR CELLS, VOLUME 3. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Nov. 1978 - Oct. 1979

Brian Carrigan Nov. 1979 176 p Supersedes NTIS/PS-1116; NTIS/PS-77/0958; NTIS/PS-76/0801
(PB80-800717; NTIS/PS-78/1116; NTIS/PS-77/0958; NTIS/PS-76/0801) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Worldwide research on the development of solar energy conversion devices using silicon ribbons, sheets, films, crystals, and wafers is cited. The preparation, purity, crystal defects, and efficiency of these cells are covered. The economics of solar cell development is discussed. The effects of radiation and weathering on performance are included. This updated bibliography contains 171 abstracts, all of which are new entries to the previous edition. GRA

N80-17589# National Technical Information Service, Springfield, Va.

SILICON SOLAR CELLS, VOLUME 3. CITATIONS FROM THE NTIS DATA BASE Progress Report, Dec. 1977 - Oct. 1979

Brian Carrigan Nov. 1979 290 p Supersedes NTIS/PS-1115; NTIS/PS-77/0956; NTIS/PS-76/0800; NTIS/PS-75/628
(PB80-800691; NTIS/PS-78/1115; NTIS/PS-77/0956; NTIS/PS-76/0800; NTIS/PS-75/628) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Citations of Government sponsored research reports on silicon solar cell growth and fabrication are presented. Processes covered include chemical vapor deposition, the Czochralski method, dendritic growth, ribbon growth, epitaxial growth, and silicon sheet fabrication on substrates. Silicon compound synthesis, purification, and reduction are discussed. Casting, cutting, and shaping of silicon solar cells are included. Solar energy conversion efficiency and performance are described. Abstracts on costs and production of these cells are covered. This updated bibliography contains 209 abstracts, 75 of which are new entries to the previous edition. GRA

N80-17590# National Technical Information Service, Springfield, Va.

SILICON SOLAR CELLS, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1976 - Oct. 1978

Brian Carrigan Nov. 1979 201 p
(PB80-800709) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Worldwide research pertaining to solar energy conversion devices using silicon ribbons, sheets, films, crystals, and wafers is cited. The preparation, purity, crystal defects, and efficiency of these cells are covered. Solar cell development costs are discussed. The effects of radiation and weathering on performance are described. This updated bibliography contains 196 abstracts, none of which are new entries to the previous edition. GRA

N80-17591# National Technical Information Service, Springfield, Va.

DESIGN AND APPLICATIONS OF FLYWHEELS, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Aug. 1978

Guy E. Habercom, Jr. Oct. 1979 264 p
(PB80-800303) Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

The design and varied applications of flywheels and reaction wheels are investigated in these Government-sponsored research reports. Such diversified applications as satellite stabilization, surface vehicle propulsion, energy transfer devices, and inertia or friction welding are reviewed. This updated bibliography contains 258 abstracts, none of which is new to the previous edition. GRA

N80-17592# National Technical Information Service, Springfield, Va.

DESIGN AND APPLICATIONS OF FLYWHEELS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, Sep. 1978 - Sep. 1979

Guy E. Habercom, Jr. Oct. 1979 99 p Supersedes NTIS/PS-78/0997; NTIS/PS-77/0882; NTIS/PS-76/0767; NTIS/PS-75/743; NTIS/PS-75/070
(PB80-800311; NTIS/PS-78/0997; NTIS/PS-77/0882; NTIS/PS-76/0767; NTIS/PS-75/743; NTIS/PS-75/070) Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

Federally funded research in the design and use of flywheels and reaction vehicles is cited in 93 abstracts, all of which are new to the previous edition. Applications considered incude energy storage for surface vehicle propulsion, inertia or friction welding, and satellite attitude control. A.R.H.

N80-17593# National Technical Information Service, Springfield, Va.
DESIGN AND APPLICATIONS OF FLYWHEELS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Oct. 1979
Guy E. Habercom, Jr. Oct. 1979 271 p Supersedes NTIS/PS-78/0998; NTIS/PS-77/0883; NTIS/PS-76/0768
(PB0-800329; NTIS/PS-78/0998; NTIS/PS-77/0883; NTIS/PS-76/0768) Avail: NTIS HC $30.00/MF $30.00 CSCL 13I

This bibliography cites 266 reports from world literature relating to the design and use of flywheels and reaction wheels for such applications as satellite attitude control, surface vehicle propulsion, energy transfer devices, and inertia or friction welding. Of the entries, 44 are new to the previous edition. A.R.H.

N80-17594# National Technical Information Service, Springfield, Va.
COMBINED CYCLE POWER GENERATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Oct. 1979
Audrey S. Hundemann Nov. 1979 158 p Supersedes NTIS/PS-78/1156; NTIS/PS-77/0991
(PB80-800915; NTIS/PS-78/1156; NTIS/PS-77/0991) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Federally-funded research pertaining to design, efficiency, cost, resource requirements, and environmental aspects of combined cycle power plants is discussed. Abstracts primarily deal with use of coal gasification in conjunction with combined gas and steam turbine generation, including subsystems development studies. This updated bibliography contain 151 abstracts, 45 of which are new entries to the previous edition. GRA

N80-17595# National Technical Information Service, Springfield, Va.
COMBINED CYCLE POWER GENERATION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Oct. 1979
Audrey S. Hundemann Nov. 1979 195 p Supersedes NTIS/PS-78/1157; NTIS/PS-77/0992
(P80-800923; NTIS/PS-78/1157; NTIS/PS-77/0992) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Design, performance, efficiency, economics, and environmental aspects of combined cycle power plants are discussed. Abstracts of worldwide research cover the use of waste heat from gas turbines to drive steam turbines and the thermal efficiency of integrated gasification combined cycle plants using low or intermediate Btu gas. A few abstracts pertain to control and instrumentation used in the plants. This updated bibliography contains 189 abstracts, 36 of which are new entries to the previous edition. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-17596 *Michigan Technological Univ., Houghton.*
SIMULATION AND MEASUREMENT OF DISPERSING GASEOUS EXHAUST EMISSIONS FROM DIESEL ENGINES IN A MINE ENVIRONMENT Ph.D. Thesis
Harold Joseph Schock, Jr. 1979 236 p
Avail: Univ. Microfilms Order No. 8001318

The production and transport of pollutants in an underground mine were analyzed for the case of an operator working in a dead-ended drift. Experiments were conducted to determine the relative merits of induction ventilation at the entrance to the drift, ventilation of the drift with positive displacement tubing, and no auxiliary ventilation. It was found that ventilation with positive displacement tubing provided the best removal of diesel generated pollutants. Using a mathematical model, the effects of exhaust pipe location and time spent out of the drift were determined and the relationship between CO2 and NO levels was investigated. The exhaust pipe location was shown to have a significant impact on operator exposure to exhaust gases. It was also shown that NO concentration varied directly with CO2 levels. Author

N80-17597# California Univ., Berkeley. Lawrence Berkeley Lab.
REGIONAL ENVIRONMENT-ENERGY DATA BOOK: WESTERN REGION
Dec. 1978 435 p refs
(Contract W-7405-eng-48)
(DOE/TIC-10114/2; LBL-7821) Avail: NTIS HC A19/MF A01

This document provides a compilation of regional data relating to the energy, environmental, socioeconomic, and institutional characteristics of the West. The document is divided into four chapters. Chapter one includes current and historic data on energy supply, demand, and production; sector fuel demands, fuel consumption, transmission, and transportation; location of energy production and conversion; and energy prices by sector and state. Chapter two shows a variety of natural and preternatural characteristics including water quality and quantity; air quality and air quality control areas; natural and induced climatic conditions; waste disposal; land and coast conditions, use, and management; managed and endangered species; demographic and socioeconomic conditions; and health and mortality data. Included in Chapter three are a variety of organizational, legislative, and regulatory data. Chapter four provides energy equivalents, metric conversions, an index, and a glossary. DOE

N80-17598# California Univ., Berkeley. Lawrence Berkeley Lab.
REGIONAL ENVIRONMENT-ENERGY DATA BOOK: SOUTHERN REGION
Dec. 1978 832 p refs
(Contract W-7405-eng-26)
(DOE/TIC-10114/4; ORNL-5443) Avail: NTIS HC A99/MF A01

Regional data relating to the energy, environmental, socioeconomic, and institutional characteristics of the South is compiled. Chapter one includes current and historic data on energy supply, demand, and production; sector fuel demands, fuel consumption, transmission, and transportation; location of energy production and conversion; and energy prices by sector and state. Chapter two shows a variety of natural and preternatural characteristics including water quality and quantity; air quality and air quality control areas; natural and induced climatic conditions; waste disposal; land and coast conditions, use, and management; managed and endangered species; demographic and socioeconomic conditions; and health and mortality data. Included in Chapter three are a variety of organizational, legislative, and regulatory data. Chapter four provides energy equivalents, metric conversions, an index, and a glossary. DOE

N80-17599# Battelle Pacific Northwest Labs., Richland, Wash.
REGIONAL ENVIRONMENT-ENERGY DATA BOOK: NORTHWEST REGION
Dec. 1978 864 p refs
(Contract W-7405-eng-36)
(DOE/TIC-10114/5; PNL-RAP-28) Avail: NTIS HC A99/MF A01

A compilation of regional data relating to the energy, environmental, socioeconomic, and institutional characteristics of the Northwest is presented. The document is divided into four chapters and includes data on the following: energy supply, demand, and production; environmental quality; natural and induced climatic conditions; waste disposal; land and cost conditions, use, and management; managed and endangered species; demographic and socioeconomic conditions; and health and mortality. DOE

N80-17600# Geological Survey, Champaign, Ill. Water Resources Div.
CHEMICAL ANALYSES OF SURFACE WATER IN ILLINOIS, 1975-77. VOLUME 1: DES PLAINES RIVER BASIN AND LAKE MICHIGAN
David Grason and R. W. Healy Apr. 1979 224 p refs Prepared in cooperation with Ill. State Environmental Protection Agency
(PB-299912/6; USGS/WRD/WRI-79/041) Avail: NTIS HC A10/MF A01 CSCL 13B

Samples of surface water were collected and analyzed. The results from water years 1975 to 1977 are presented in tabular form, and the history of sampling and analytical methods during that period are summarized. Stream discharge data from records of the U.S. Geological Survey are included for all sites where samples were collected at gaging stations or near enough that reliable discharge estimates could be made. GRA

N80-17601# Geological Survey, Champaign, Ill. Water Resources Div.

CHEMICAL ANALYSES OF SURFACE WATER IN ILLINOIS, 1975-77. VOLUME 2: ILLINOIS RIVER BASIN AND MISSISSIPPI RIVER TRIBUTARIES NORTH OF ILLINOIS RIVER BASIN

David Grason and R. W. Healy Apr. 1979 287 p refs Prepared in cooperation with Ill. State Environmental Protection Agency
(PB-299913/4; USGS/WRD/WRI-79/042; USGS/WRI-79/24)
Avail: NTIS HC A13/MF A01 CSCL 13B

Samples of surface water collected at 590 sites were analyzed and the results are presented in tabular form. Stream discharge data from records of the U.S. Geological Survey are included if the sampling site was at or near a gaging station. K.L.

N80-17602# Geological Survey, Champaign, Ill. Water Resources Div.

CHEMICAL ANALYSES OF SURFACE WATER IN ILLINOIS, 1975-77. VOLUME 3: OHIO RIVER TRIBUTARIES AND MISSISSIPPI RIVER TRIBUTARIES SOUTH OF ILLINOIS RIVER BASIN

David Grason and R. W. Healy Apr. 1979 246 p refs Prepared in cooperation with Ill. Environmental Protection Agency
(PB-299914/2; USGS/WRD/WRI-79/043; USGS/WRI-79/25)
Avail: NTIS HC A11/MF A01 CSCL 13B

Results from the analysis of surface water samples are presented in tabular form, and the history of sampling and analytical methods during that period are summarized. Stream discharge data from records of the U.S. Geological Survey are included for all sites where samples were collected at gaging stations or near enough that reliable discharge estimates could be made. GRA

N80-17603# PEDCo-Environmental, Inc., Cincinnati, Ohio.

ASSESSMENT OF ENVIRONMENTAL IMPACT OF THE MINERAL MINING INDUSTRY Final Report

J. S. Greber, V. D. Patel, E. A. Pfetzing, R. S. Amick, and R. O. Toftner Jul. 1979 289 p
(Contract EPA-68-03-2479)
(PB80-103492; EPA-600/2-79-107) Avail: NTIS HC A13/MF A01 CSCL 13B

A multimedia (air, liquid and solid wastes) environmental assessment of the domestic mineral mining industry is presented. Major pollution problems associated with the industry are identified. Research and development needs for adequate control of air pollutants and liquid and solid wastes connected with mineral mining are defined. GRA

N80-17604# National Water Well Association, Worthington, Ohio.

PROCEEDINGS OF THE NATIONAL GROUND WATER QUALITY SYMPOSIUM (4TH). Final Report, 6 Feb. 1978 - 5 Feb. 1979

Aug. 1979 181 p refs Repr. from Ground Water, v. 17, no. 1, Jan.-Feb. 1979 and v. 17, Mar.-Apr. 1979 Conf. held at Minneapolis, 20-22 sep. 1978 Sponsored in part by National Water Well Assoc.
(Grant EPA-R-805747)
(PB80-103476; EPA-600/9-79-029) Avail: NTIS HC A09/MF A01 CSCL 13B

Thirty-four papers are presented in debate format addressing various aspects of ground water quality. Water pollution, land use, and pollution control were the major subject areas. R.E.S.

N80-17605# Environmental Monitoring and Support Lab., Las Vegas, Nev.

DISTRIBUTION OF PHYTOPLANKTON IN TEXAS LAKES Progress Report, 15 Mar. - 20 Nov. 1974

M. K. Morris, W. D. Taylor, L. R. Williams, S. C. Hern, and V. W. Lambou Jun. 1979 122 p refs Prepared in cooperation with Nevada Univ., Las Vegas
(PB80-103401; EPA-600/3-79-070) Avail: NTIS HC A06/MF A01 CSCL 13B

Species and abundance of phytoplankton in the 38 lakes in Texas are reported. Results from the calculation of several water quality indices also include (Nygaard's Trophic State Index, Palmer's Organic Pollution Index, and species diversity and abundance indices). GRA

N80-17606# Geological Survey, University, Ala. Div. of Water Resources.

GROUND-WATER MANAGEMENT TECHNIQUES FOR THE CONTROL OF SALT-WATER ENCROACHMENT IN GULF-COAST AQUIFERS Summary Report

Gary R. Walter, Robert E. Kidd, and George M. Lamb 1979 95 p refs Prepared jointly with OWRT, Washington, D.C.
(PB80-102965; W80-00490; OWRT-B-073-ALA-1) Avail: NTIS HC A05/MF A01 CSCL 13B

The fresh ground-water resources of the Gulf Shores area of Alabama occur in four principal aquifiers. In order of increasing depth, these are designated the Beach Sand aquifer, the Gulf Shores aquifer, the 350-Foot aquifer, and the 500-Foot aquifer. Only in the Beach Sand aquifer can the cases of salt-water contamination be unequivocably attributed to seawater encroachment. Based on the results of numerical modeling and interpretation of the water chemistry, the cases of contamination in the Gulf Shores aquifer may be due to leakage of saline water around well bores, leakage from confining beds and movement of pockets of relic salt water within the aquifer rather than lateral seawater encroachment. GRA

N80-17607# Connecticut Univ., Storrs. Inst. of Water Resources.

POTENTIAL GROUND WATER POLLUTION FROM SEWAGE SLUDGE APPLICATION ON AGRICULTURAL LAND Technical Completion Report, Jul. 1976 - Sep. 1979

R. William Wengel and Gary F. Griffin Sep. 1979 20 p refs Prepared for OWRT, Washington, D.C.
(Contract DI-14-31-0001-6007)
(PB80-102957; W80-00489; OWRT-A-074-CONN-1) Avail: NTIS HC A02/MF A01 CSCL 13B

Corn for silage was grown for three years on land treated with either annual applications or a single application of limed, dewatered sewage sludge at six rates of application. Yields of silage, heavy metal uptake, soil heavy metals, soil nitrates, and soil pH were measured. Soil pH increased under all sludge applications in proportion to rate and total amount of sludge applied. High soil pH reduced extractability of soil metals and also crop uptake of zinc. Soil Cd, Cu, Ni, Pb, and Zn increased with sludge application rate only in the plow layer. No leaching of these metals occurred. Soil nitrates increased with sludge application rate. Leaching and accumulation of nitrates at depths of 244 cm were shown at high application rates. GRA

N80-17608# Southwest Research Inst., San Antonio, Tex.

ENVIRONMENTAL MONITORING OF A WASTEWATER TREATMENT PLANT Final Report, Oct. 1977 - Mar. 1978

D. E. Johnson, D. E. Camann, H. J. Harding, and C. A. Sorber Aug. 1979 137 p refs
(Grant EPA-R-805533)
(PB80-103211; EPA-600/1-79-027) Avail: NTIS HC A07/MF A01 CSCL 06F

A wastewater aerosol monitoring program was conducted at an advanced wastewater treatment facility using the activated sludge process. Wastewater aerosols containing pathogenic organisms are generated by the aeration basin and by an aerated surge basin. From a preliminary microbial screen of the wastewater, predominant indicator and pathogenic microorganisms were selected for routine wastewater and aerosol monitoring. The geometric mean aerosol concentrations at 30 to 50 meters downwind of the aeration basin were 5.8 cfu/cum of total coliforms, 2.0 cfu/cum of fecal streptococci, 9.1 cfu/cum of mycobacteria, 7 cfu/cum of pseudomonas, and 0.7 pfu/cum of coliphage. GRA

N80-17609# Benham-Blair and Affiliates, Inc., Oklahoma City, Okla.

LONG-TERM EFFECTS OF LAND APPLICATION OF

DOMESTIC WASTEWATER: DICKINSON, NORTH DAKOTA, SLOW RATE IRRIGATION SITE
Aug. 1979 180 p refs Prepared in cooperation with Engineering Enterprises, Inc., Norman, Okla.
(Contract EPA-68-02-2363)
(PB80-102643; EPA-600/2-79-144) Avail: NTIS
HC A09/MF A01 CSCL 02C

The long term effects of applying treated domestic wastewater to farmland at Dickinson, North Dakota are reported. Slow rate irrigation, using the border-strip method, has been practiced since 1959. Water soil, and crop samples from this test site were compared with similar samples from a nearby control site irrigated with well water. Samples were also taken to detect coliform bacteria. Thirteen parameters were found to be present at significantly greater concentrations in the effluent used to irrigate the test site than in the river water used to irrigate the control site. GRA

N80-17610# Teknekron, Inc., McLean, Va.
A STUDY OF RADIOACTIVE AIRBORNE EFFLUENTS FROM PARTICLE ACCELERATORS Final Report
Joel L. Cehn Aug. 1979 117 p refs
(Contract EPA-68-01-4997)
(PB80-101314; ORP/TAD-79/12) Avail: NTIS
HC A06/MF A01 CSCL 18H

Radioactive gas production and release around non-Federally owned particle accelerators is discussed. The estimated 1200 non-Federally owned accelerators in the United States are categorized by type and energy, and the potential for radiogas production is discussed for various types. The results of field monitoring around two machines (a cyclotron and a Van de Graaff) are also presented. Estimates of annual radiogas releases from generic accelerator facilities are made. The isotopes of interest are tritium from a generic Van de Graaff; nitrogen-13, oxygen-15, and carbon-11 from a generic cyclotron; and argon-41 from a generic linac. Control technologies to reduce airborne releases of these isotopes are discussed. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N80-17611 Miami Univ., Coral Gables, Fla.
AN APPLICATION OF AMINO ACID RACEMIZATION THE DETERMINATION OF PALEOHEAT FLOW Ph.D. Thesis
Barry Jay Katz 1979 251 p
Avail: Univ. Microfilms Order No. 8001662

A kinetic model for the racemization of isoleucine in foraminifera was developed from pre-existing data. The differing thermal histories of the samples whether due to variations in bottom water temperatures or the effects of deep burial and the subsequent effects of the natural geothermal gradient were considered. Material obtained from the Deep Sea Drilling Project was evaluated in light of this kinetic model. Calculated reaction temperatures (CRTs) were commonly above those expected for thermal equilibrium with both past and present bottom water temperatures. The calculated reaction temperatures increased with increasing depth and related to the effects of the geothermal gradient through time. This effect quantified through the substitution of a function of heat flow into an Arrhenius equation. The time averaged heat flows calculated through this process were commonly in agreement with available geologic and geophysical information. Dissert. Abstr.

N80-17612 Northwestern Univ., Evanston, Ill.
GLOBAL CYCLING BEHAVIOR OF TRACE METALS Ph.D. Thesis
Ronald Joseph Lantzy 1979 180 p
Avail: Univ. Microfilms Order No. 7927392

Global atmospheric input data for 20 trace metals are presented and the relative importance of natural and anthropogenic surfaces are assessed. A mathematical model was derived and used to calculate enrichment Factors (EFs) based on natural and anthropogenic influxes, effluxes, and interhemispheric transfer rates. The calculated EFs agree with observed EFs at mid and high latitude for lithophile metals, but only at mid latitude for atmophile metals. At high latitude calculated EFs for atmophile metals were lower than observed EFs. To explain these observations and calculations, several additional sources of atmospheric trace metals are discussed. Model calculations show that cessation of anthropogenic trace metal emissions would result in a return of enrichment factors to preindustrial values in less than one year. Other significant observations and results are given. Dissert. Abstr.

N80-17613 Case Western Reserve Univ., Cleveland, Ohio.
DISTRIBUTION PATTERNS OF HOLOCENE AND REWORKED PALEOZOIC PALYNOMORPHS IN SEDIMENTS FROM SOUTHEASTERN LAKE MICHIGAN Ph.D. Thesis
Martha R. Fletcher 1979 331 p
Avail: Univ. Microfilms Order No. 8001478

The distribution and origin of Holocene and reworked Paleozoic palynomorphs extracted from sediments from rivers tributary to Lake Michigan, from soil and bedrock of the river drainage basins, and from gravity-core tops and subsurface sediments from south-western Lake Michigan is examined. Relative pollen frequencies (percentages) and pollen concentration data are supplemented by preservation-quality data for all identifiable grains. Important controls of ultimate pollen distribution in the lake are location and vegetation of the source area, differential transport depending on grain density, differential resistance to decay, lake circulation patterns, and flowering season. A post-glacial spruce zone is reported for the first time in Lake Michigan, and the changing pattern of abundances of reworked and long-transported pollen and Paleozoic spores in the lower parts of one core support other evidence for the abrupt end of a Lake Michigan-Lake Superior connection in the lower Holocene. Dissert. Abstr.

N80-17614 California Inst. of Tech., Pasadena.
REGIONAL VARIATIONS IN THE LEAD ISOTOPIC CHARACTERISTICS OF LATE CENOZOIC BASALTS FROM THE SOUTHWESTERN UNITED STATES Ph.D. Thesis
Joel Earl Everson 1979 464 p
Avail: Univ. Microfilms Order No. 7920352

The lead isotopic systematics of volcanic rocks in the southwestern United States can be divided into three broad regional groups: one characteristic of Colorado Plateau volcanic fields, a second found in many areas of the Basin and Range province, and in neighboring areas along the Pacific coast, and a third peculiar to an area in southern Nevada. Colorado Plateau volcanic rocks have generally unradiogenic leads, locally exhibit large variations in isotopic ratio. Basin and Range type samples are characterized by relatively radiogenic leads and, comparatively, a uniformity of isotopic composition in local areas. Southern Nevada leads are somewhat unradiogenic, appear to display a local uniformity in isotopic composition, and lie off the Colorado Plateau secondary isochrons. Dissert. Abstr.

N80-17615 California Univ., Los Angeles.
MAGNETIC FLUCTUATIONS IN THE FREQUENCY RANGE 0.1 TO 1 HERTZ OBSERVED UPSTREAM FROM THE EARTH'S BOW SHOCK Ph.D. Thesis
Donald Duane Childers 1979 177 p
Avail: Univ. Microfilms Order No. 7921387

Variations in the magnetic field as observed upstream from the Earth's bow shock are investigated. Power spectra of upstream fields undisturbed by bow shock associated effects are presented for the frequency range .01< or = f approx. < 1 Hz. Magnetic fields disturbed by bow-shock-related effects measured in the upstream region on both sides of the sun-earth direction are found to have similar power spectra over the range .01< or = f approx. < 1 Hz. The salient spectral characteristic of these fields is a strong peak in the range 0.01 - 0.05 Hz, marked by significant coherences among the vector components at the peak frequency. The spatial distribution of the upstream field fluctuations in the range 0.07 < or = f approx. < 1 Hz is presented and evidence of a bow shock process as the dominant factor behind the subject turbulence in this region is given. In addition, a large number of the high frequency, highly coherent discrete wave packets often observed in the upstream region are investigated. Dissert. Abstr.

N80-17616 Institut d'Aeronomie Spatiale de Belgique, Brussels.
TERRESTRIAL SPACE: BIBLIOGRAPHY, FASCICLE 16A
1978 158 p refs
Avail: Issuing Activity

A bibliography of scientific works relative to the Earth's space environment is presented. Subject headings include meteorology, geomagnetism, auroras, and airglow. Also covered are studies of the ionosphere. Subheadings deal with the D region, E region, and F region. The topside region, whistlers, and general problems are treated as well. Author (ESA)

N80-17617 Institut d'Aeronomie Spatiale de Belgique, Brussels.
TERRESTRIAL SPACE: BIBLIOGRAPHY, FASCICLE 16B
1978 140 p refs
Avail: Issuing Activity

International in scope, this bibliography cites 760 documents relating to the earth's space environment. Topics cover solar radiation; cosmic rays; the structure of the upper atmosphere; and satellite orbits with emphasis on potential. Atmospherics are considered from the point of view of homosphere, aeronomical chemistry, the heterosphere, interaction between neutral and ionized atmosphere, the exosphere, and the magnetosphere. Author (ESA)

N80-17618*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A PROPOSED CONCEPT FOR A CRUSTAL DYNAMICS INFORMATION MANAGEMENT NETWORK
Guy M. Lohman and J. Thomas Renfrow 15 Jan. 1980 116 p refs
(Contract NAS7-100)
(NASA-CR-162765; JPL-Pub-79-111) Avail: NTIS HC A06/MF A01 CSCL 08E

The findings of a requirements and feasibility analysis of the present and potential producers, users, and repositories of space-derived geodetic information are summarized. A proposed concept is presented for a crustal dynamics information management network that would apply state of the art concepts of information management technology to meet the expanding needs of the producers, users, and archivists of this geodetic information. J.M.S.

N80-17619# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
A SURVEY OF CURRENTLY IMPORTANT EMPIRICAL THERMOSPHERIC MODELS Interim Report
David R. Hickman, Barbara K. Ching, Carl J. Rice, Lawrence R. Sharp, and Joe M. Straus 14 Sep. 1979 188 p refs
(Contract F04701-78-C-0079)
(AD-A075748; TR-0079-4960-04-2; SAMSO-TR-79-57) Avail: NTIS HC A09/MF A01 CSCL 04/1

A description of currently important empirical thermospheric models is given, and the relative advantages of each are discussed. In addition, a comprehensive set of contour plots of total density is presented to allow more detailed examination of quantitative aspects of the models. GRA

N80-17620# Dayton Univ., Ohio.
THE 1977 ROBIN PROGRAM, USER'S MANUAL
John F. Myers and James K. Luers Jul. 1979 42 p refs
(Contract DAAD07-78-C-0020)
(AD-A075443; ERADCOM/ASL-CR-79-0020-1) Avail: NTIS HC A03/MF A01 CSCL 04/1

The Robin 77 or revised High Altitude Robin Program is specifically designed for computer reduction of Robin flights which attain an apogee of approximately 125 km, and are tracked by an FPS/16 radar. The program also provides accurate reduction for Robin flights attaining other apogees between 65 and 150 km. If a passive sphere other than the 1-m Robin approximately 115 g is used, reduction with this program is still possible. There may be times, however, when drag coefficients are not available and thus density, temperature, and pressure cannot be computed. The time of fall test used to determine spheres collapse is not used for sphere with dimensions that differ from the Robin. At each second of flight, the program calculates altitude, wind components and direction, density, temperature, and pressure, the RMS noise error winds, density, temperature and pressure, and other balloon dynamics. Author (GRA)

N80-17621# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
CORRELATED OBSERVATIONS OF AURORAL ARCS, ELECTRONS, AND X-RAYS FROM A DMSP SATELLITE Interim Report
Paul F. Mizera, Janet G. Luhmann, Wojciech A. Kolasinski, and J. Bernard Blake 28 Sep. 1979 22 p refs
(Contract F04701-78-C-0079)
(AD-A075207; TR-0079(4960-05)-2; SAMSO-TR-79-53) Avail: NTIS HC A02/MF A01 CSCL 04/1

The first simultaneous observations, made from a single DMSP satellite, of visible auroral arcs, precipitating primary electrons, and atmospheric bremsstrahlung X-rays are presented for a moderately disturbed auroral event. Measured electron fluxes were used to compute absolute X-ray distributions expected at the satellite altitude. The agreement between the calculated and measured X-ray spectra is sufficiently good to suggest that global auroral energy input can be monitored by an orbiting X-ray spectrometer. GRA

N80-17622# Webb Associates, Yellow Springs, Ohio.
THE PRECIPITATING ELECTRON DETECTORS (SSJ/3) FOR THE BLOCK 5D/FLIGHTS 2-5 DMSP SATELLITES: CALIBRATION AND DATA PRESENTATION Final Report, 1 Jan. 1977 - 30 Sep. 1978
M. S. Gussenhoven, D. A. Hardy, and A. Huber Aug. 1979 64 p refs
(Contract F49620-77-C-0050)
(AD-A075114; AFOSR-79-1060TR) Avail: NTIS HC A04/MF A01 CSCL 04/1

The work under this contract had as its goal the time-dependent phenomenological modeling of the polar cap regions. The vehicle for modeling the caps has been to analyze the following collection of data DMSP images showing polar cap auroras DMSP electron measurements hourly averages of the interplanetary magnetic field ground magnetometer data from Thule and magnetic indices. DMSP images from the winters of 1972-1973 and 1974-1975 provided consistently good records of the northern polar cap regions and were used as the primaary basis of the study. The DMSP images for these periods were traced and gridded in corrected geomagnetic coordinates and local geomagnetic time. The subset of cases for which auroras occur at above 80 degrees corrected geomagnetic latitude was identified and further categorized by local time interval of occurrence morning, midnight, evening sectors. The occurrence of extremely high latitude aurora in each category was correlated with magnetic indices, magnetometer response at Thule, and solar wind parameters. The correlation of cap size as determined by poleward auroral boundaries, and the time variation of these with the above parameters was also made. GRA

N80-17623# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
AN EFFECTIVE STRESS MODEL FOR GROUND MOTION CALCULATIONS Final Report, Oct. 1977 - Jun. 1979
George Y. Baladi Sep. 1979 118 p refs
(AD-A076537; WES-TR-SL-79-7) Avail: NTIS HC A06/MF A01 CSCL 14/2

This report documents the development of a three-dimensional, elastic-plastic, work-hardening constitutive model based on the theory of effective (intergranular) stress for the purpose of simulating the response of isotropic three-phase (partially saturated) earth materials. This model can be used to perform effective stress ground shock analyses. The model is actually a marriage of two single-phase elastic-plastic models which simulate, respectively, the drained and undrained stress-strain behavior of earth media, and whose coefficients can all be determined experimentally using conventional laboratory testing techniques. Fitting the model, therefore, requires an extra set of laboratory tests (the drained tests) over that required to fit a contemporary (total stress) ground shock model. The feasibility of using the new model for effective stress ground shock analyses is demonstrated numerically by solving a simplified two-dimensional airslap problem for a saturated sand halfspace using an effective stress version of the LAYER code. The real power of this computational tool has yet to be investigated by applications against actual field experiments. Appendix A reviews the fundamentals of elastic-plastic models. GRA

N80-17624# Sperry Rand Corp., Great Neck, N. Y. Sperry Systems Management.
SEISMIC PROFILING SYSTEMS Final Report
Apr. 1979 18 p
(Contract N00014-78-C-0208)
(AD-A076262; Rept-2542.1579) Avail: NTIS
HC A02/MF A01 CSCL 08/11

A Seismic Profiling System was delivered on 30 January 1978 for temporary installation and operation aboard the NR-1. In order to have the equipment installed and tested in time for a planned mission, it was necessary to substitute an Edo Model 550A recorder in lieu of the final Model 615-2 recorder. The model 615-2 recorder was still in production at this time, but was subsequently delivered to the NR-1 and the Model 550A recorder was returned to the vendor. It has been reported that the seismic profiling equipment performed satisfactorily during the entire mission. The Model 615-2 recorder which has replaced the Model 550A recorder is more compact and mounts in the 2300 equipment rack, a considerable advantage over the unwieldy size of the latter recorder. The final equipment was delivered in accordance with the contract requirements. GRA

N80-17625# Ohio State Univ., Columbus. Electroscience Lab.
TROPOSPERIC WATER VAPOR ABSORPTION IN THE INFRARED WINDOW REGIONS Ph.D. Thesis
Michael E. Thomas Aug. 1979 251 p refs
(Contract DAAG29-77-C-0010)
(AD-A076267; ESL-784701-5; ARO-14702.4-GS) Avail: NTIS
HC A12/MF A01 CSCL 04/1

Attenuation of infrared radiation in the troposphere is dominated by water vapor absorption. Most past work on the spectroscopy of water vapor has been on the analysis of the rotational and vibrational bands. As a result a thorough listing of line positions, line strengths and halfwidths exists today. Because of the weak 'continuum' absorption in the water vapor windows centered at 10 and 4 microns, efforts to measure and model the continuum have not been as successful as efforts in the analysis of the bands. Yet a precise understanding of continuum absorption is important for long path energy transmission. The purpose of this study is to demonstrate the importance of far wing phenomena in characterizing H2O continuum absorption. A total line shape for water vapor-nitrogen interactions valid under tropospheric conditions is derived. The model is tested using a set of experimental room temperature H2O continuum measurements of high quality. Using this data base parameters of the far wing component of the total line shape are determined. GRA

N80-17626# Electronics Research Lab., Adelaide (Australia).
PRELIMINARY ASSESSMENT OF INFRA-RED TRANSMISSION DATA MEASURED OVER OCEAN-TYPE WATERS IN A TEMPERATE ENVIRONMENT
D. R. Cutten Mar. 1979 44 p refs
(AD-A073417; ERL-0063-TM) Avail: NTIS HC A03/MF A01
CSCL 04/1

Measurements have been made of the near sea infra-red transmission of the atmosphere over paths of 5 and 9 km in a temperature environment. Seven broadband spectral regions have been used and variations with absolute humidity, temperature and visibility are investigated. The data are compared with the predictions of the AFGL computer model LOWTRAN3B. A discrepancy has appeared between the measured and calculated data for the 4.4 to 5.4 micrometers region due, possibly, to either no water continuum absorption being included in the model or an under-estimation of the N2 continuum absorption. Indications are that the dependence of water vapour continuum transmission on precipitable water and temperature in the 8.2 to 11.8 micrometers region may not be accurately described by the LOWTRAN3B model. GRA

N80-17627# Science Applications, Inc., La Jolla, Calif.
SATELLITE MEASUREMENTS OF TROPOSPHERIC AEROSOLS
M. Griggs 30 Aug. 1979 17 p refs Presented at the 23rd Ann. Intern. Symp. of the Soc. of Photo-Opt. Instr. Engr., San Diego, Calif., 29 Aug. 1979
(Contract N00014-77-C-0489)
(AD-A075579; SAI-011-79-1004-LJ) Avail: NTIS
HC A02/MF A01 CSCL 04/1

This report develops a number of upper and lower bounds for the reliability of multistate systems, that is, systems for which each component may exist in one of a finite number of states. These bounds are based on notions of multistate minimal paths and minimal cuts. The bounds are far more easily computed than the exact system reliability. In order to further reduce the computations required and obtain sharper bounds, a modular-decomposition-based bound is developed for multistate systems. GRA

N80-17628# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
THE MICROPHYSICS OF ICE CLOUDS - A SURVEY Interim Report
Rosemary M. Dyer and Arnold A. Barnes, Jr. 8 May 1979 39 p refs
(AF Proj. 2310)
(AD-A077020; AFGL-TR-79-0103) Avail: NTIS
HC A03/MF A01 CSCL 04/1

Published results of observations of crystal habits, particle sizes and numbers of ice particles in clouds are summarized and discussed. There are systematic variations with cloud type, and in some instances, with cloud age and location within a cloud system. However, the body of data available is insufficient to formulate a climatology of ice cloud microphysics. The several measurement techniques in current use are evaluated, as are some of the techniques now under consideration for future use. The particle enhancement observed on some occasions is discussed, and the various theories accounting for it presented. Finally, recommendations are made concerning future field programs and theoretical studies required before accurate predictions of the ice cloud microphysical environment can be made. GRA

N80-17629# California Univ., Berkeley. Lawrence Berkeley Lab.
FAULT INTERSECTIONS AND HYBRID TRANSFORM FAULTS IN THE SOUTHERN SALTON TROUGH GEOTHERMAL AREA, BAJA CALIFORNIA, MEXICO
S. VonderHaar and I. PuenteCruz (Comision Federal de Electricidad, Mexico City) Jul. 1979 5 p refs Presented at Geothermal Resources Council Ann. Meeting, Reno, Nev., 24 Sep. 1979
(Contract W-7405-eng-48)
(LBL-9458; CONF-790906-28) Avail: NTIS
HC A02/MF A01

Analysis of 55 wells drilled at the Cerro Prieto Geothermal Field and a suite of geological and geophysical studies throughout the southern Salton Trough from the Mexican-United States border to the Gulf of California clarify two concepts important to geothermal development: increased natural convective fluid flow and better permeability should occur at intersecting faults both regionally and within a producing field, and the Cerro Prieto and Imperial faults are best conceived of as hybrid types having features of both San Andreas style wrench faults and oceanic transform faults. DOE

N80-17630# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
POTENTIAL AND INDUCTIVE ELECTRIC FIELDS IN THE MAGNETOSPHERE DURING AURORAS
W. J. Heikkila (Texas Univ., Dallas), R. J. Pellinen (Finn. Meteorol. Inst.), C. G. Faalthamaar, and L. P. Block Mar. 1979 21 p refs Submitted for publication
(TRITA-EPP-79-02) Avail: NTIS HC A02/MF A01

Magnetospheric processes responsible for auroral activity are discussed. Results show that during quiescent auroras the large scale electric field in essentially irrotational. The volume formed by the plasma sheet and its extension into the auroral oval is connected to an external energy source by electric currents which enter and leave the volume at different electric potentials as well as supplying sufficient energy to support the auroral activity. The location of the actual acceleration of particles depends on the internal distribution of electric fields and currents. One important feature is the energization of the carriers of the cross-tail current and another is the acceleration of electrons precipitated through relatively low altitude, magnetic field aligned, potential drops. Substorm auroras depend on rapid and (especially initially) localized release of energy that can only be supplied by tapping stored magnetic energy. Author (ESA)

N80-17631# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
AN EMPIRICAL DETERMINATION OF THE PRODUCTION EFFICIENCY FOR AURORAL 6300 A EMISSION BY ENERGETIC ELECTRONS
G. G. Shepherd, J. D. Winningham (Texas Univ., Dallas), F. E. Bunn (York Univ., Toronto), and F. W. Thirkettle (York Univ., Toronto) Jun. 1979 21 p refs
(TRITA-EPP-79-10) Avail: NTIS HC A02/MF A01

Auroral data from the Soft Particle Spectrometer and the Red Line Photometer on the ISIS-2 spacecraft were selected to form an electron energy flux and optical auroral emission data base. The energy fluxes are stored as integrated fluxes over four energy bands and the corresponding stored optical emission rates are corrected for airglow and for albedo. Because of the variety of electron energy spectra represented in the data base it was possible to perform a regression analysis that yielded the production efficiency for the production of emission for each of the four bands. The significance of this approach is that it permits a multiparameter description of an electron energy spectrum, and its relationship to a specific optical emission, by purely empirical means. Author (ESA)

N80-17632# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
FIELD LINE PROJECTIONS OF 6300 A AURORAL EMISSIONS INTO THE OUTER ATMOSPHERE
Marian M. Shepherd (York Univ., Toronto, Canada) Jul. 1979 10 p refs
(TRITA-EPP-79-11) Avail: NTIS HC A02/MF A01

An empirical magnetospheric model was employed to project auroral intensity boundaries into the magnetosphere. The auroral data are in the form of instantaneous maps of 6300 A emission, acquired with the ISIS-2 spacecraft, and correspond to fluxes of low energy electrons. These are specific to a particular universal time and date. The purely empirical magnetospheric model used includes the dipole tilt as a variable and permits selection from four different disturbance levels. In a general way, the auroral projections agree with what is expected, giving some confidence in this application of the model. However, a number of features appear that were not predicted and which should permit new insights into the relationship of specific auroral boundaries to the structure of the magnetosphere. Author (ESA)

N80-17633# Royal Netherlands Meteorological Inst., De Bilt.
SEISMOLOGICAL BULLETIN OF THE SEISMOGRAPH STATIONS IN THE NETHERLANDS, VOLUME 60, 1972
1979 111 p
(KNMI-108-60) Avail: NTIS HC A06/MF A01

The geographic coordinates of the Dutch seismograph stations are given and the instruments used at each station are described. Data analysis, including interpretation of microseismic activity, is discussed. Results are presented in tabular form. Author (ESA)

N80-17249 Geological Survey, Washington, D. C.
EARTHQUAKES: THEIR CAUSES AND EFFECTS
Robert M. Hamilton *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 19-21 (For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-17634 Deutscher Wetterdienst, Offenbach am Main (West Germany).
EQUIPMENT AND METHODS FOR MEASURING LOCAL AND OVERALL PRECIPITATION [NEUE GERAETE UND METHODEN ZUR MESSUNG DES PUNKT- UND FLAECHENNIEDERSCHLAGES]
Walter Attmannspacher 1978 17 p refs In GERMAN; ENGLISH summary
(ISBN-3-88148-163-X; ISSN-0072-4130) Avail: NTIS HC A02

The ombrometer HP with its three sensors for measuring duration and amount of precipitation is described. Basic problems associated with fog/precipitation measurement by a single ombrometer are discussed. Examples of this measurement using A-band and C-band radar are given. Results from C-band radar measurement are compared with a statistical study of synchronous radar rain gage measurement. The studied rain gage network is described. A fully automatic radar precipitation measurement system is considered. Author (ESA)

N80-17635 Deutscher Wetterdienst, Offenbach am Main (West Germany).
WIND FORCE ANALYSIS FOR THE FEDERAL REPUBLIC OF GERMANY TO DETERMINE THE USEFULNESS OF WIND POWER [DIE WINDVERHAELTNISSE IN DER BUNDESREPUBLIK DEUTSCHLAND IM HINBLICK AUF DIE NUTZUNG DER WINDKRAFT]
W. Benesch, G. Duensing, G. Jurksch, and R. Zoellner 1978 145 p refs In GERMAN; ENGLISH summary Original contains color illustrations
(ISBN-3-88148-164-8) Avail: NTIS HC A07

The utilization of wind force in inland areas is investigated on the basis of data sets from 74 stations from the period 1969 to 1974. The dependence of the annual means and average annual cumulative frequencies of wind velocity on elevation is evaluated. Analyses on the duration of threshold values of wind velocity are also made. A number of sites suitable for wind power utilization are identified. Author (ESA)

N80-17636 Direction de la Meteorologie Nationale, Paris (France).
CYCLOGENESIS IN THE WESTERN MEDITERRANEAN BASIN [CYCLOGENESIS DU BASSIN MEDITERRANEEN OCCIDENTAL]
Claude Fons Jan. 1979 62 p refs In FRENCH
(MN-Mono-109) Avail: NTIS HC A04

Several case histories of cyclogenesis in the western Mediterranean basin are presented. Preponderant effects on the evolution of low pressure zones in this area are orographic. Analysis shows that fronts moving down the Rhone Delta coincide with the development of numerous depressions over the Mediterranean sea and with the occurence of high winds (30 knots and over). A considerable drop in high altitude pressure is also noted. Maximum variations in geopotential are seen at 300 mbars. A specific technique for long range forecasting in this region is proposed. Author (ESA)

N80-17637# Federal Aviation Administration, Atlantic City, N.J.
MANUAL VOICE INPUT SUBSYSTEM OF THE NAFEC MASS WEATHER DISSEMINATION SYSTEM Interim Report
Paul Quirk and Louis Delemarre Nov. 1979 29 p
(FAA Proj. 131-401-800)
(AD-A077074; FAA-RD-79-12; FAA-NA-79-21) Avail: NTIS HC A03/MF A01 CSCL 04/2

The development, test, evaluation, and application of digital technology to the mass dissemination of meteorological and aeronautical information is investigated. The prototype model is a fully automated system designed to transfer a significant amount of workload from the FSS specialist to system hardware and to provide better service to the flying public. M.M.M.

N80-17638*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DOCUMENTATION OF THE FOURTH ORDER BAND MODEL
Eugenia Kalnay-Rivas and David Hoitsma (Sigma Data Services Corp.) Dec. 1979 117 p refs Submitted for publication

(NASA-TM-80608) Avail: NTIS HC A06/MF A01 CSCL 04B

A general circulation model is presented which uses quadratically conservative, fourth order horizontal space differences on an unstaggered grid and second order vertical space differences with a forward-backward or a smooth leap frog time scheme to solve the primitive equations of motion. The dynamic equations for motion, finite difference equations, a discussion of the structure and flow chart of the program code, a program listing, and three relevent papers are given. M.G.

N80-17639*# Cornell Univ., Ithaca, N. Y.

DEVELOPMENT OF A SEVERE LOCAL STORM PREDICTION SYSTEM: A 60-DAY TEST OF A MESOSCALE PRIMITIVE EQUATION MODEL Final Report, 1 Dec. 1976 - 30 Sep. 1978

Douglas A. Paine, John W. Zack, and Michael L. Kaplan (General Electric Management and Technical Service Co., Hampton, Va.) 1979 147 p refs
(Grant NsG-1365)
(NASA-CR-162756) Avail: NTIS HC A07/MF A01 CSCL 04B

The progress and problems associated with the dynamical forecast system which was developed to predict severe storms are examined. The meteorological problem of severe convective storm forecasting is reviewed. The cascade hypothesis which forms the theoretical core of the nested grid dynamical numerical modelling system is described. The dynamical and numerical structure of the model used during the 1978 test period is presented and a preliminary description of a proposed multigrid system for future experiments and tests is provided. Six cases from the spring of 1978 are discussed to illustrate the model's performance and its problems. Potential solutions to the problems are examined. A.W.H.

N80-17640*# George Washington Univ., Washington, D. C. School of Engineering and Applied Science.

PROGRAM OF RESEARCH IN SEVERE STORMS Final Report

31 Oct. 1979 24 p refs
(Grant NsG-1251)
(NASA-CR-162764) Avail: NTIS HC A02/MF A01 CSCL 04B

Two modeling areas, the development of a mesoscale chemistry-meteorology interaction model, and the development of a combined urban chemical kinetics-transport model are examined. The problems associated with developing a three dimensional combined meteorological-chemical kinetics computer program package are defined. A similar three dimensional hydrostatic real time model which solves the fundamental Navier-Stokes equations for nonviscous flow is described. An urban air quality simulation model, developed to predict the temporal and spatial distribution of reactive and nonreactive gases in and around an urban area and to support a remote sensor evaluation program is reported. A.W.H.

N80-17641*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

GUIDELINES FOR THE AIR-SEA INTERACTION SPECIAL STUDY: AN ELEMENT OF THE NASA CLIMATE RESEARCH PROGRAM, JPL/SIO WORKSHOP REPORT

15 Feb. 1980 53 p refs
(Contract NAS7-100)
(NASA-CR-162792; JPL-Pub-80-8) Avail: NTIS HC A04/MF A01 CSCL 04B

A program in the area of air sea interactions is introduced. A space capability is discussed for global observations of climate parameters which will contribute to the understanding of the processes which influence climate and its predictability. The following recommendations are some of the suggestions made for air sea interaction studies: (1) a major effort needs to be devoted to the preparation of space based climatic data sets; (2) NASA should create a group or center for climatic data analysis due to the substantial long term effort that is needed in research and development; (3) funding for the analyses of existing data sets should be augmented and continued beyond the termination of present programs; (4) NASA should fund studies in universities, research institutions and governments' centers; and (5) the planning for an air sea interaction mission should be an early task. F.C.T.

N80-17642# Army Command and General Staff Coll., Fort Leavenworth, Kansas.

PROBABILITY WEATHER FORECASTS FOR THE ARMY Final Report M.S. Thesis

Arthur C. Kyle 8 Jun. 1979 116 p refs
(AD-A076190) Avail: NTIS HC A06/MF A01 CSCL 04/2

The United States Army presently receives weather forecasts expressed in categorical terms. However, this forecast form limits the useful information that can be communicated to the decision maker. This study investigates the utility of replacing categorical forecasts with probability forecasts in order to enhance decision making by Army commanders. To this end, the advantages and limitations of probability forecasts are reviewed. The principal conclusion of this study is that Army commanders would benefit from receiving probability weather forecasts. Finally, several recommendations for smoothing the conversion are given and a briefing that a Staff Weather Officer can use a basis for showing an Army commander the utility of probability forecasts is provided. GRA

N80-17643# Florida State Univ., Tallahassee. Dept. of Statistics.

A MULTIVARIATE METHODOLOGY FOR THE ANALYSIS OF WEATHER MODIFICATION EXPERIMENTS

Elton Scott Aug. 1979 73 p refs
(Contract N00014-76-C-0394)
(AD-A076164; FSU-Statistics-M514; TR-147-ONR) Avail: NTIS HC A04/MF A01 CSCL 04/2

This paper develops applications of multivariate statistical models, particularly principal component analysis, to the analysis of data from weather modification experiments. The efficacy of these multivariate applications is examined by applying the proposed models to data from Phase 1 of the Santa Barbara Convective Band Seeding Program conducted for the Navy by North American Weather Consultants. Multivariate summary measures of precipitation are developed and multivariate methods are given to analyze the effects of cloud-seeding on precipitation. Results from these models, based on the above-mentioned data set, are reported along with conclusions and suggestions for further work. An appendix provides detailed summary statistics for the analyses. Author (GRA)

N80-17644# Air Force Environmental Technical Applications Center, Scott AFB, Ill.

ELMENDORF AFB, ANCHORAGE, ALASKA: REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO), PARTS A-F Final Report

17 Sep. 1979 477 p
(AD-A076085; USAFETAC/DS-79-071) Avail: NTIS HC A21/MF A01 CSCL 04/2

This report is a six-part statistical summary of surface weather observations for Elmendorf AFB, Anchorage, Alaska. It contains the following parts (1) Weather Conditions; Atmospheric Phenomena; (2) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (3) Surface Winds; (4) Ceiling Versus Vicibility; Sky Cover; (5) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew-point temperatures and relative humidity); and (6) Pressure Summary (means, standard, deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurence or cumulative percentage frequency of occurrence tables. GRA

N80-17645# Air Force Environmental Technical Applications Center, Scott AFB, Ill.

FORT SILL AAF, LAWTON, OKLAHOMA: REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSO), PARTS A-F Final Report

19 Sep. 1979 672 p
(AD-A076080; USAFETAC/DS-78/086) Avail: NTIS HC A99/MF A01 CSCL 04/2

This report is a six-part statistical summary of surface weather observations for Fort Sill AAF, Lawton, Oklahoma. It contains the following parts: (1) Weather Conditions; Atmospheric Phenomena; (2) Precipitation Snowfall and Snow Depth (daily amounts and extreme values); (3) Surface Winds; (4) Ceiling Versus Visibility; Sky Cover; (5) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew-point temperatures and relative humidity); and (6) Pressure Summary (means, standard, deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables. GRA

N80-17646# Air Force Environmental Technical Applications Center, Scott AFB, Ill. Data Processing Div.
GRAY AAF, FORT LEWIS, LACEY, WASHINGTON: REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO), PARTS A-F Final Report
Asheville, N.C. 23 Feb. 1979 445 p
(AD-A076079; USAFETAC/DS-79-085) Avail: NTIS
HC A19/MF A01 CSCL 04/2

This report is a six-part statistical summary of surface weather observations for Fort Lewis, Lacey, Washington. It contains the following parts: (1) Weather Conditions Atmospheric Phenomena (2) Precipitation Snowfall and Snow Depth (daily amounts and extreme values (3) Surface Winds, (4) Ceiling Versus Visibility Sky Cover, (5) Psychrometric Summaries (daily maximum and minimum temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew-point temperatures and relative humidity); and (6) Pressure Summary (means, standard, deviations and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables. GRA

N80-17647# Naval Postgraduate School, Monterey, Calif.
DETERMINATION OF VERTICAL WIND SHEAR FROM LINEAR COMBINATIONS OF SATELLITE RADIANCE GRADIENTS: A THEORETICAL STUDY Technical Report, 1 Oct. 1978 - 22 Sep. 1979
Sep. 1979 44 p refs
(AD-A075213; NPS63-79-004) Avail: NTIS
HC A03/MF A01 CSCL 04/2

By applying the thermal wind equation to the radiative transfer equation, one can derive the vertical wind shear from horizontal gradients of radiances measured by satellite. The vertical resolution of the wind shear can be optimized by using linear combinations of radiance gradients. A theoretical study was conducted to determine the optimal pressure intervals over which wind shears could be resolved when using weighting functions associated with the SSH sounder of the Defense Meteorological Satellite Program, and those associated with the TOVS instrument package on the TIROS-N/NOAA series of operational satellites. Two distinct computational approaches are presented and their respective results are summarized. GRA

N80-17648# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
LANGLEY AFB, NEWPORT NEWS, VIRGINIA: REVISED UNIFORM SUMMARY OF SURFACE WEATHER Final Report
1 Jun. 1979 478 p
(AD-A076083; USAFETAC/DS-79/069) Avail: NTIS
HC A21/MF A01 CSCL 04/2

This report is a six-part statistical summary of surface weather observations for Langley AFB, Newport News, Virginia. It contains the following parts: (1) Weather Conditions; Atmospheric Phenomena; (2) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (3) Surface Winds; (4) Ceiling Versus Visibility; Sky Cover; (5) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew-point temperatures and relative humidity); and (6) Pressure Summary (means, standard, deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables. GRA

N80-17649# New Mexico State Univ., Las Cruces. Physical Science Lab.
HELICOPTER REMOTE WIND SENSOR (HRWS) GROUND TEST
J. E. Ottesen and David H. Dickson Oct. 1979 21 p refs
(Contract DAAD07-79-C-0008)
(AD-A077142; ERADCOM/ASL-CR-79-0008-2) Avail: NTIS
HC A02/MF A01 CSCL 04/2

Ground tests of the Helicopter Remote Wind Sensor (HRWS) were run at Biggs Optical Range (BOR) to determine the suitability of the HRWS for measuring low-level cross winds for surface launched weapons ballistics. The HRWS accurately measured winds under a variety of atmospheric turbulence conditions. Average absolute differences (with respect to the BOR) were 0.6 m/s for point measurement, 0.8 m/s for the near field, and 1.3 m/s for a 500-m path. GRA

N80-17650# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
FORT HUACHUCA, HUACHUCA CITY, ARIZONA: REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO), PARTS A-F Final Report
20 Aug. 1979 509 p refs
(AD-A076070; USAFETAC/DS-79/088) Avail: NTIS
HC A22/MF A01 CSCL 04/2

This report is a six-part statistical summary of surface weather observations for Fort Huachuca, Huachuca City, Arizona. It contains the following parts: (1) Weather Conditions; Atmospheric Phenomena; (2) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (3) Surface Winds; (4) Ceiling Versus Visibility; Sky Cover; (5) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature means and standard deviations of dry-bulb, wet-bulb and dew-point temperatures and relative humidity); and (6) Pressure Summary (means, standard, deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables. GRA

N80-17651# Deutscher Wetterdienst, Hohenpeissenberg (West Germany).
RESULTS OF AEROLOGICAL AND SURFACE OZONE MEASUREMENTS [SONDERBEOBACHTUNGEN DES METEOROLOGISCHEN OBSERVATORIUMS HOHENPEISSENBERG. NR. 37. ERGEBNISSE DER AEROLOGISCHEN UND BODENNAHEN OZONMESSUNGEN IM 1. HALBJAHR 1978]
1978 193 p In GERMAN; ENGLISH summary
(ISSN-0581-1287; ISSN-0343-7426) Avail: NTIS
HC A09/MF A01

Ozone measurements made during the first half of 1978 at Hohenpeissenberg, Germany, are reported. Surface ozone was measured near the ground while total ozone was measured using a Dobson spectrophotometer. Results are presented in tabular form. Author (ESA)

N80-17652# Deutscher Wetterdienst, Hohenpeissenberg (West Germany).
DETAILED AEROLOGICAL TABLES FROM THE INTERNATIONAL OZONE SURVEY [SONDERBEOBACHTUNGEN DES METEOROLOGISCHEN OBSERVATORIUMS HOHENPEISSENBERG. NR. 38. AUSFUGHRLICHE AEROLOGISCHE TABELLEN DES INTERNATIONALEN OZONSONDENVERGLEICHS 3.4.-21.4. 1978]
1978 104 p In GERMAN
(ISSN-0581-1287; ISSN-0343-7426) Avail: NTIS
HC A06/MF A01

Ozone measurements from five countries (USA, Japan, India, West Germany, and East Germany) are reported and compared. Four different sondes were used, the results of which are given in tabular form. Author (ESA)

N80-17653# Deutscher Wetterdienst, Hohenpeissenberg (West Germany).
RESULTS OF AEROLOGICAL AND SURFACE OZONE MEASUREMENTS IN THE SECOND HALF OF 1978 [SONDERBEOBACHTUNGEN DES METEOROLOGISCHEM OBSERVATORIUMS HOHENPEISSENBERG. NR. 39. ERGEBNISSE DER AEROLOGISCHEN UND BODENNAHEN OZONMESSUNGEN IM 2. HALBJAHR 1978]
1979 174 p In GERMAN; ENGLISH summary
HC A08/MF A01

Ozone measurements, made twice a week at Hohenpeissenberg, Germany are reported. Surface ozone was measured conventionally near the ground while total ozone was determined using a Dobson spectrophotometer. Results are given in tabular form. Author (ESA)

N80-17654# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
METHODS OF STEREOSCOPIC CLOUD ANALYSIS FROM SPACE
Dieter Lorenz and Erich Schmidt May 1979 42 p refs Original contains color illustrations
(DLR-Mitt-79-04) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 10,60

Stereoscopic cloud imaging from weather satellites to facilitate cloud analysis and improve cloud height determination is discussed. Cloud imaging is performed from a geostationary as well as from a polar orbit. A system for a nearly polar operational weather satellite to meet special European requirements is proposed. The system consists of an optomechanical stereoscopic line scanner with two inclined scan planes and with visible and thermal infrared channels for day and night imaging. The integration of an additional laser altimeter for height measurements of reference points makes it possible to correct the influence of wind on cloud height determination (caused by nonsynchronous imaging) as well as to detect winds from cloud motion. Both optical and electronic methods can be used for image display and processing. Author (ESA)

N80-17655# Royal Netherlands Meteorological Inst., De Bilt.
METEOROLOGY AND THE FORECASTING OF AIR POLLUTION. THE USE OF DAILY AIR QUALITY CRITERIA IN FUEL CHOICE FOR ELECTRIC POWER STATIONS [EEN STUDIE VAN DE TOEPASSING VAN METEOROLOGISCHE EN LUCHTVERONTREIGINGSCRITERIA BIJHET VOEREN VAN EEN BRANDSTOFKEUZEBELEID VOOR ELECTRICTEITSCENTRALES]
H. VanDop, N. D. VanEgmond (RIV, Bilthoven, Netherlands), and J. F. DenTonkelaar 1979 30 p refs In DUTCH; ENGLISH summary
(KNMI-WR-79-8) Avail: NTIS HC A03/MF A01

An air pollution forecast based on meteorological parameters was tested. The meteorological parameters included in the forecast are the daily average wind speed, the strength of the nocturnal inversion, and the daily maximum mixing height. The observed and 24 hour forecast values were compared over a period of five years. The correlation between the forecast indexes for one, two, and three days in advance and the observed values are 0.64, 0.48, and 0.34, respectively. The forecast was investigated as a possible decision parameter for fuel choice in big electric power plants in the Netherlands. The underlying strategy is to use fuel with a high sulfur content (oil) during days with a low air pollution potential. It is shown that a fuel choice strategy based on the forecast results in better air quality than was observed without any strategy under the same conditions. Author (ESA)

N80-17656# Royal Netherlands Meteorological Inst., De Bilt.
THE EFFECTS OF WEATHER SHIPS ON NUMERICAL ANALYSIS AND PREDICTION
H. Timmerman 1979 16 p refs
(KNMI-WR-79-9) Avail: NTIS HC A02/MF A01

The results of a numerical experiment are described. The intention of this experiment was to obtain sustaining arguments for the use of weatherships. The test consisted of two series analysis and forecasts on an octagonal grid, almost covering the Northern Hemisphere. The only difference between the two series is a difference in the observational data: one set with, the other without weatherships. The effect of the observations of weatherships was studied by comparing the measured heights of 500 mbar with values analyzed with and without weatherships. Results show that omission of the weatherships leads to an average increase in the rms of 2.8 dam. to 4.8 dam. Author (ESA)

N80-17657# Royal Netherlands Meteorological Inst., De Bilt.
A BAROCLINIC FOUR LEVEL MODEL WITH FILTERED EQUATIONS [EEN BAROKLIEN VIERLAGEN-MODEL MET GEFILTERDE VERGELIJKINGEN]
A. W. DenExterBlokland 1979 52 p refs In DUTCH; ENGLISH summary
(KNMI-WR-79-12) Avail: NTIS HC A04/MF A01

The design of a simple four level baroclinic quasi-geostrophic model with filtered equations is described. The basic vorticity, thermodynamic, continuity, hydrostatic, and state equations are presented. The dry model is constructed by setting the humidity term equal to zero. The horizontal divergences on the mbar levels and the vertical velocity are eliminated using the integrated continuity equation with the vertical velocity equal to zero at the boundaries. Four prognostic equations, with the four tendencies of the stream functions as unknowns, are derived. The variations of the coriolis parameter over the globe is taken into account. Author (ESA)

N80-17658# Royal Netherlands Meteorological Inst., De Bilt.
THERMAL WIND ESTIMATES FROM SYNOPTIC AIR TEMPERATURE OBSERVATIONS
G. J. Cats Jun. 1979 13 p refs
(KNMI-V-324) Avail: NTIS HC A02/MF A01

The variance, correlation, and climatology parameterizations required in the optimum interpolation analysis of 1.5 m air temperature are given. Application of the optimum interpolation method leads to horizontal temperature gradient estimates that correlate significantly with the difference between observed 1500 m wind and the surface geostrophic wind. From surface observations of pressure and air temperature a reliable estimate of upper winds (around heights of 1500 m) can be formed. Author (ESA)

N80-17659# Royal Netherlands Meteorological Inst., De Bilt.
WIND PROFILE ESTIMATES UP TO 200 m FROM SYNOPTIC OBSERVATIONS
G. J. Cats 1979 21 p refs
(KNMI-V-326) Avail: NTIS HC A02/MF A01

A scheme for estimating the friction velocity (u) and the Obukhov length (L) from synoptic observations is described. Businger's flux-profile relationships are used. The estimated values of (u) are in very good agreement with values obtained from fitting Businger's profiles to observations of wind speed and temperature profiles up to 20 m. The estimated values of (L) show less agreement, especially during the night. The estimated (u) and (L) lead to good wind speed estimates up to a height of 200 m in near neutral conditions. Under very unstable conditions the correlation coefficient between estimated and observed wind speeds is small, but, because of the low average wind speed, the root-mean-square error of estimate is also small < 1.7 m/sec at 200 m). Under very stable conditions the estimation scheme leads to completely erroneous results (at 200 m, e.g., the rms error of estimate is 4 m/sec), because the Businger relations are applied far beyond their application range. Author (ESA)

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-17660 Florida State Univ., Tallahassee.
SURFACE LITHOFACIES, BIOFACIES, AND DIATOM DIVERSITY PATTERNS AS MODELS FOR DELINEATION

OF CLIMATIC CHANGE IN THE SOUTHEAST ATLANTIC OCEAN Ph.D. Thesis
David Richard Defelice 1979 240 p
Avail: Univ. Microfilms Order No. 8001091

The distribution of diatom species in surface sediments of the southeast Atlantic Ocean is studied. Low diversity stress flora along the Polar Front, Antarctic slope, and the northern boundary of winter sea ice reflect unstable, unpredictable environments. Downcore analysis of cores lying adjacent to the Polar Front and the diatom ooze-pelagic clay boundary show evidence for past climatic variations. The low trophic level occupied by diatoms and the subsequent sensitivity of these organisms to abiotic environmental parameters such as light quality, make relative diatom abundance a useful tool for monitoring fluctuations of winter sea ice and the temperature changes responsible for these fluctuations. The position of the Polar Front migrated at least three times within the last 0.015 my BP. Within the last 0.3 my BP warm maxima have occurred at approximately 0.0, 0.015, 0.125 and 0.3 my BP. Dissert. Abstr.

N80-17661# Meteorology International, Inc., Monterey, Calif.
THE EXPANDED OCEAN THERMAL-STRUCTURE ANALYSIS SYSTEM: A DEVELOPMENT BASED ON THE FIELDS BY INFORMATION BLENDING METHODOLOGY Final Report
Manfred M. Holl, Michael J. Cuming, and Bruce R. Mendenhall Jul. 1979 222 p refs
(Contract N00014-79-C-0236)
(AD-A076534; MII-M-241) Avail: NTIS HC A10/MF A01 CSCL 08/10

The Expanded Ocean Thermal-Structure (EOTS) analysis system, an application of the general-purpose Fields by Information Blending (FIB) methodology, is an advanced, comprehensive and flexible system for four-dimensional analysis of thermal structure from the ocean surface to the bottom. Using surface (ships, buoys, satellites) and sounding observations and information carried and accrued along the time axis from previous analyses and climatologies, analyses may be performed for any region and for any grid resolution in space and time. Significant variabilities in the vertical profile are represented by a set of thermal-structure parameters--absolute values, gradients and curvatures. Special provision is made for fine-resolution of thermal structure in the vicinity of the Primary Layer Depth and for restricting flow of information across land barriers. EOTS may be used for real-time synoptic analyses and, using available data bases, for production of historical sequences and climatologies. A wide variety of optional outputs includes horizontal and vertical sections of temperature and sound speed. This report provides a comprehensive account of the FIB information-processing concepts and formulations upon which EOTS is based. Samples of EOTS-generated output are included. A user's manual for the EOTS analysis system is also available. GRA

N80-17662# Naval Postgraduate School, Monterey, Calif.
ONE-DIMENSIONAL MODEL PREDICTIONS OF OCEAN TEMPERATURE ANOMALIES DURING FALL, 1976 Technical Report, Dec. 1978 - Aug. 1979
Russell L. Elsberry, Patrick C. Gallacher, and Roland W. Garwood, Jr. Aug. 1979 30 p refs
(AD-A075212; NPS63-79-003) Avail: NTIS HC A03/MF A01 CSCL 08/10

The hypothesis that upper Ocean temperature anomalies that developed over the North Pacific Ocean during the fall-winter of 1976-77 were primarily generated by vertical mixing processes was tested using the Garwood (1977) mixed layer model. A series of points along 175 deg W and along 38 deg N were chosen for use in this preliminary study. Atmospheric forcing for the one-dimensional ocean model was derived from the surface heat budget calculations in the Fleet Numerical Weather Central (FNWC) atmospheric prediction model. The suitability of the FNWC heat flux calculations was evaluated through comparison with the upper ocean heat content changes derived from the TRANSPAC analyses. The comparisons showed better agreement along 175 deg W than along 38 deg N. A series of ocean thermal structure predictions from 15 September to 31 December 1976 were made using the time series of the atmospheric forcing and the initial profile from the September TRANSPAC analysis. In the central region near 38 deg N, 165 deg W the predicted thermal structure agreed very well with the TRANSPAC analysis for December 1976. Near the southern and western ends of the domain, the temperature predictions were systematically lower than the analyzed values between the surface and 200 m. GRA

N80-17663# Delaware Univ., Newark. Coll. of Marine Studies.
WAVELIKE BAROCLINIC DISTURBANCES ON SHALLOW UPPER OCEAN DENSITY FRONTS
Richard A. Fornato Mar. 1979 226 p refs Prepared in cooperation with Connecticut Univ., Storrs
(Contracts N00014-78-C-0071; N00014-75-C-0714)
(AD-A076248; CMS-C-1-79) Avail: NTIS HC A11/MF A01 CSCL 08/10

A theoretical development of small amplitude wave disturbances on oceanic fronts is presented. The prototype front is the inshore boundary of the Gulf Stream, although the model encompasses a wider range of applicability. This work is an extension of recent research by Garvine which showed the importance of dissipation near the surface front, and earlier work by Duxbury on large scale time varying inviscid flow regimes. A two-layer model is considered in which the lower layer is much deeper than the upper, lighter layer. The upper layer, including the frontal zone, is then dynamically uncoupled from the lower layer. The frontal zone that forms the horizontal boundary of the upper layer is divided into two regions, a smaller, inner region in which the flow is dissipative and depends upon interfacial mass entrainment and turbulent friction, and a larger, outer region in which the motion is inviscid. The boundary between these two regions is placed where the internal Froude number is of order one. GRA

N80-17664# Royal Netherlands Meteorological Inst., De Bilt.
SEA SURFACE TEMPERATURE AND MIXED LAYER DEPTH DURING THE JASIN 78 EXPERIMENT
P. Kruseman and G. J. Prangsma 1979 14 p
(KNMI-V-325) Avail: NTIS HC A02/MF A01

The general interest data set from the JASIN-78 experiment is presented. Eight sea surface temperature charts and a plot of mixed layer depth versus time are presented to give a rough estimate of the conditions during the experiment. Author (ESA)

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-17665 Michigan State Univ., East Lansing.
INTERACTION OF ELECTROMAGNETIC FIELDS WITH HETEROGENEOUS BIOLOGICAL SYSTEMS Ph.D. Thesis
Sutus Rukspollmuang 1979 207 p
Avail: Univ. Microfilms Order No. 8001585

The theoretical and experimental results of the induced electric field inside a biological system when it is irradiated by a non-ionized electromagnetic (EM) radiation are presented. A numerical method based on a tensor integral equation is outlined for estimating the induced EM heating. A phantom model of man which was constructed with thin plexiglass filled with phantom material, was irradiated by 500 to 3000 MHz EM waves in a microwave anechoic chamber. The distribution of the measured electric field was compared with the distribution of theoretical results obtained numerically from the tensor integral equation method. A quantitative agreement was obtained between experiment and theory. A study was also conducted to investigate effective methods of inducing hyperthermia in the tumors embedded in animal and human bodies by utilizing EM fields. Dissert. Abstr.

N80-17666*# National Aeronautics and Space Administration, Washington, D. C.
NEW STUDIES OF VENUS
L. V. Ksanfomaliti Feb. 1980 18 p Transl. into ENGLISH from Zemlya Vselennaya (USSR), no. 4, Jul. - Aug. 1979 p 5-14 Transl. by JPRS, Arlington, Va.
(NASA Order W-13183)
(NASA-TM-75931) Avail: NTIS HC A02/MF A01 CSCL 03B

The American and Russian 1978 Venus explorations are reported. Highlights of their accomplishments and subjects of study are discussed. Included are investigations of the surface pressure, temperature, composition, and mass of the Venusian atmosphere, along with cloud layer structure, greenhouse effect, and diurnal variations. M.M.M.

N80-17667*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF GRAVITATIONAL OVERLOADS, HYPOKINESIA AND HYPODYNAMIA ON THE VESSELS OF THE PULMONARY BLOOD CIRCUIT

A. A. Kasimtsev Feb. 1980 13 p refs Transl. into ENGLISH from Arkh. Anat., Gistol. Embriol. (USSR), no. 2, 1973 p 82-90 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by 1st Leningrad I. M. Pavlov Medical Inst.
(Contract NASw-3199)
(NASA-TM-75963) Avail: NTIS HC A02/MF A01 CSCL 06C

Vessels of the pulmonary circuit are studied under normal conditions, in exposure to single stress or continuous threshold endurable chestspine gravitational stresses, and one to eight week hypokinesia and hypodynamic effects followed by stress. Examination methods include rentgenography and microrentgenography, clearing, and histology. In exposure to gravitational stress the distal portions of the arterial vessels of the 3 and 4 orders constrict, while all veins dilate. Sinuosity of all vessels is noted. The volume of the capillary bed increases and signs of perivascular edema occur. Due to hypokinesia and hypodynamia the arteries constricted and the arterial bed becomes poor. The veins of all orders dilate and the volume of the capillary bed increases. The changes grew greater the longer the terms of hypodyamic effects. Successive combination of hypokinesia and hypodynamia and gravitational stresses cause more pronounced changes than separate effects of these two factors and result in great deformity of the vascular walls, including their rupture and penetration of formed elements beyond the limits of the vascular bed. M.G.

N80-17668*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF GRAVITATIONAL ACCELERATION, HYPOKINESIA AND HYPODYNAMIA ON THE STRUCTURE OF THE INTESTINAL VASCULAR BED

M. V. Nikitin Feb. 1980 12 p refs Transl. into ENGLISH from Arkh. Anat., Gistol. Embriol. (USSR), no. 3, Mar. 1974 p 54-61 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by 1st Leningrad I. P. Pavlov Medical Inst.
(Contract NASw-3199)
(NASA-TM-75972) Avail: NTIS HC A02/MF A01 CSCL 06C

A series of experiments comparing single and combined effects of hypokinesia and gravitational acceleration on morphology of intestinal blood vessels are discussed. Results indicate that hypokinesia has a whole body nonspecific effect reflected even in an organ whose activity shows little or no change due to hypokinesia. In early hypokinetic stages blood redistribution caused anorexia, intestinal atonia, and secretory disruption. Destructive changes from further exposure include aneurisms, varicoses, extravascular movement of blood elements, and vascular wall muscle fiber degeneration. The effect of acceleration is greatest in the ventrodorsal direction. Changes due to acceleration then hypokinesia are like those due to hypokinesia alone; changes due to acceleration before and after hypokinesia are like those due to acceleration. Adaptation raises acceleration tolerance but the effects do not survive four-week hypokinesia. M.G.

N80-17669*# National Aeronautics and Space Administration, Washington, D. C.

INFLUENCE OF MOBILITY RESTRICTION ON HABITUATION OF THE VESTIBULAR APPARATUS

G. I. Gorgiladze and G. S. Kazanskaya Feb. 1980 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), v. 211, no. 4, 1 Aug. 1973 p 1005-1008 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75995) Avail: NTIS HC A02/MF A01 CSCL 06C

Test results presented indicate that 30-day hypokinesia did not affect the intensity of nystagmus: velocity of slow phase, total number of jerks, and duration of the reaction in animals were the same as before mobility restriction and did not differ from those of the control group. However, hypokinesia resulted in the disappearance of habituation of the vestibulary system to repeated angular accelerations. The known hypokinetic changes in the endocrine system were studied. It was concluded that reduction in adrenergic function may be the cause of disappearance of vestibular apparatus habituation during hypokinesia. M.M.M.

N80-17670*# National Aeronautics and Space Administration, Washington, D. C.

RNA CONTENT IN MOTOR AND SENSORY NEURONS AND SURROUNDING NEUROGLIA OF MOUSE SPINAL CORD UNDER CONDITIONS OF HYPODYNAMIA AND FOLLOWING NORMALIZATION

V. A. Brumberg and L. A. Pevzner Feb. 1980 15 p refs
(Contract NASw-3198)
(NASA-TM-76032) Avail: NTIS HC A02/MF A01 CSCL 06C

The differences in the dynamics of reparative processes in RNA metabolism within the neuron-neuroglia unit after the cessation of hyper- and hypodynamia is dicussed. The role of neuroglia is stressed in compensatory, reparative and trophic processes in the nervous system as well as the possibility in an adaptation at the cellular level. M.M.M.

N80-17671*# National Aeronautics and Space Administration, Washington, D. C.

DIFFERENTIATION AND RADIOSENSITIVITY OF HEMOPOIETIC STEM CELLS OF MICE DURING HYPOKINESIA

V. N. Shvets 1980 10 p refs Transl. into ENGLISH from Radiobi. (USSR), v. 19, no. 2, 1979 p 199-203 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76066) Avail: NTIS HC A02/MF A01 CSCL 06C

The potential for differentiation and radiosensitivity of the stem hemopoietic cells (KOE) under conditions of initial and later hypokinesia is examined. It is established that in the initial period of hypokinesia (3 days) when a stress reaction prevails, changes occur in the erythroid differentiation and radiosensitivity of KOE. This effect is associated with redistribution of T-lymphocytes that increase in number in the bone marrow of mice during hypokinesia. At later periods of hypokinesia (30 days) when changes in the organism are related to hypokinesia proper, differentiation and radiosensitivity of KOE were normalized. M.G.

N80-17672*# National Aeronautics and Space Administration, Washington, D. C.

DYNAMICS OF CHANGE IN RAT ARTERIAL PRESSURE UNDER CONDITIONS OF IMMOBILIZATION

Ye. A. Yumatov, Yu. G. Skotselyas, and L. I. Ivanona Feb. 1980 9 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 3, 1979 p 22-26 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original Doc. prepared by USSR Academy of Medical Sciences, Moscow
(Contract NASw-3198)
(NASA-TM-76045) Avail: NTIS HC A02/MF A01 CSCL 06C

Emotional stress developed in immobilized rats was shown to be accompanied by changes in the regulation of arterial pressure and the frequency of cardiac contractions. A group of adapting rats displayed definite resistance to emotional stress, while a group of rats incapable of adapting to acute emotional stress died with characteristics of cardiovascular insufficiency. The mechanisms providing resistance to emotional stress in numerous conflict situations were analyzed. K.L.

N80-17673# Rhode Island Univ., Kingston. Graduate School of Oceanography.

BIOCHEMICAL CORRELATES OF SEASONAL CHANGE IN MARINE COMMUNITIES

H. Perry Jeffries May 1979 19 p refs Repr. from Am. Nat., v. 113, no. 5, May 1979 p 643-658
(Grant NOAA-04-80-MO1-147)

(PB-301380/2; Marine-Reprint-119; NOAA-79082402)
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Changes in the fatty acid distributions of plankton and benthos in response to seasonal change are analyzed. It is found that as a temperate community matures and becomes more complex, so does its fatty acid composition. Chemical progression is most rapid during succession from winter-spring to summer-fall species groups, a period of reorganization among characteristic fatty acid sets. Increasing amounts of saturated acids seem to disclose a change in community structure, whereas an important polyunsaturate forms a locus around which these progressions take place.
GRA

N80-17674# Joint Publications Research Service, Arlington, Va.

USSR REPORT: SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 14, NO. 6, 1979

O. G. Gazenko, ed. 31 Jan. 1980 114 p refs Transl. into ENGLISH of Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 90 p
(JPRS-75041) Avail: NTIS HC A06/MF A01

The biological and physiological effects of manned space flight are addressed. Specifically, the selection and training of cosmonauts, the evaluation and analysis of data to facilitate the transition from orbital to interplanetary flights, and research aimed at guaranteeing safety on long flights and reliability of the human component of the man spaceship system are considered. Space psychology and physiology, environmental problems and control, and telemetry are included. For individual titles, see N80-17675 through N80-17694.

N80-17675# Joint Publications Research Service, Arlington, Va.

SOME PHILOSOPHICAL ASPECTS OF THE PROBLEM OF MAN, THE BIOSPHERE AND SPACE c52

N. A. Agadzhanyan *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 1-8 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 1-9 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

Man environment interactions are considered in terms of the laws governing evolution and further development of the Universe. The emergence of a human society is seen as a qualitatively new stage in the evolution of organic matter. Progress in science and engineering is discussed in relation to the effect on the natural environment and on living beings. Space exploration is seen as an opportunity to evaluate man's role, position, and responsibility in the infinite Universe. J.M.S.

N80-17676# Joint Publications Research Service, Arlington, Va.

COMPOSITION OF INTESTINAL MICROFLORA OF COSMONAUTS BEFORE AND AFTER SPACE FLIGHTS c52

N. N. Lizko, V. M. Shilov, G. D. Syrykh, and V. I. Legenkov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 9-20 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 9-13 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

The composition of the intestinal microflora of 12 cosmonauts was studied before and after space missions of varying duration. Changes in the intestinal microbial coenosis were found prelaunch. The pattern of changes did not vary with an increase in space flight duration. The use of special prophylactic measures exerted a positive effect on intestinal microecology. Bifidobacteria and lactobacilli showed the greatest changes inflight. Therefore, it seems important to arrange preflight sanation of the intestinal microflora as a prophylactic method. Author

N80-17677# Joint Publications Research Service, Arlington, Va.

OBJECTIVES AND CONDITIONS OF PHYSIOLOGICAL EXPERIMENTS ON RATS CONDUCTED ABOARD THE COSMOS-936 BIOSATELLITE

Ye. A. Ilin, V. I. Korolkov, A. R. Kotovskaya, A. D. Noskin, V. A. Kondratyeva, A. A. Shipov, and I. I. Britvan *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 21-26 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 18-22 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

Results of physiological studies of rats flown onboard the biosatellite Cosmos 936 are summarized. The satellite-borne experiments investigated the mechanisms of the physiological effects of weightlessness, and considered artificial gravity as an effective means of preventing the adverse effects of weightlessness. The feasibility of a control group that would be exposed to all space flight factors, with the exception of weightlessness, in order to differentiate between in the influence of weightlessness on physiological systems and the effects of other space flight factors was assessed. J.M.S.

N80-17678# Joint Publications Research Service, Arlington, Va.

SOME NEUROCHEMICAL CHARACTERISTICS OF RATS DURING FLIGHT ABOARD THE COSMOS-782 ARTIFICIAL SATELLITE AND AFTER RETURN TO EARTH

O. G. Gazenko, N. N. Demin, A. N. Panov, D. A. Rashevskaya, N. L. Rubinskaya, and R. A. Tigranyan *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 27-32 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 22-26 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

The brains of rats flown onboard the biosatellite Cosmos 782 were sampled immediately postflight and taken under neurochemical study. It was shown cytospectrophotometrically that the absolute content of RNA decreased by 20 percent in the cytoplasm of cerebellar Purkinje cells and remained unaltered in glial cells-satellites, and that the protein content did not change. In the frontal cortex (homogenates) the concentration of sulfhydryl groups decreased by 26 percent, activity of nonspecific cholinesterase by 30 percent and acetyl cholinesterase by 33 percent. The activity of the latter in the cerebellum also diminished. Author

N80-17679# Joint Publications Research Service, Arlington, Va.

EFFECTS OF MINIMAL GRAVITATIONAL LOADS ON FLUID-ELECTROLYTE METABOLISM AND RENAL FUNCTION OF MAN DURING PROLONGED IMMERSION c52

A. I. Grigoryev and Ye. B. Shulzhenko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 33-39 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 27-31 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

It was demonstrated that renal excretion of fluid, osmotically active substances and electrolytes could be reduced, using low gravitational exposures (+Gz). The degree and duration of water and electrolyte retention were different with respect to the experimental time. The major physiological mechanisms of the changes in fluid-electrolyte metabolism were: a decrease in the glomerular filtration rate and a change in water and ion transport in renal tubules. Author

N80-17680# Joint Publications Research Service, Arlington, Va.

CREATINURIA IN MAN DURING PROLONGED HYPOKINESIA c52

S. A. Kamforina *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p40-44 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 32-35 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

A prolonged bed rest experiment of 94 days caused an increase in renal excretion of creatine during the first two months and a return to the pretest level during the third month. The bed rested test subjects who performed exercise showed a lower and delayed (by the 3rd month) increase in creatine excretion.
Author

N80-17681# Joint Publications Research Service, Arlington, Va.

CHANGES IN THE NEUROMOTOR SYSTEM DURING 45 DAYS OF HYPOKINESIA c52

Ye. A. Shaposhnikov, P. I. Sidorov, and A. I. Kolomenskiy *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 45-51 refs Transl. into ENGLISH from Kosmich. Biol. Aviatkomich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 35-39 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

Neurological and electromyographic examinations of 12 test subjects during a 45 day bed rest study were carried out. Symptoms indicating changes in the suprasegmentary innervation were noted. Shortening of the duration of potentials was shown by needle electromyography. A decline in the threshold of H-reflex and a change in the frequency parameters of EMG were seen. These data suggest a change in the functional state of the central and peripheral motor neuron during prolonged hypokinesia. Prophylactic efficiency of muscle electrostimulation is discussed.
Author

N80-17682# Joint Publications Research Service, Arlington, Va.

ELECTROSTIMULATION OF MUSCLES FOR THE PREVENTION OF NEUROMUSCULAR DISORDERS DURING 45-DAY ANTIORTHOSTATIC HYPOKINESIA c52

V. S. Georgiyevskiy, Ye. A. Ilinskaya, V. I. Matveyev, V. M. Mikhaylov, and V. I. Pervushin *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 52-57 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 40-44 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

Healthy test subjects exposed to a 45 day head down tilting (-6.5 deg) showed a decline of the tone and strength of certain muscle groups, a decrease of leg circumference, a deterioration of the walking pattern, and a reduction of exercise tolerance (provocative tests with bicycle ergometry pedalling at a moderate and maximum rate). Electrostimulation of muscles applied by the Tonus-2 equipment for 30 min twice a day, 6 days a week helped to reduce the level of hypokinesia induced disorders.
Author

N80-17683# Joint Publications Research Service, Arlington, Va.

EFFECT OF VESTIBULAR STIMULI ON VISUAL TRACKING IN A LIMITED TRACKING AREA c52

V. I. Babiyak, Yu. N. Kholodov, and Yu. K. Yanov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 58-63 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov/Dec. 1979 p 49-48 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

The results of studying visual tracking of targets which moved with a constant amplitude of angular displacement are presented. The tracking was carried out during an interaction of vestibular and optic sensors. The tracking stability was related to the coincidence of the direction of vestibular and optic stimuli.
J.M.S.

N80-17684# Joint Publications Research Service, Arlington, Va.

ROLE OF INTEROCEPTIVE AFFERENTATION IN FUNCTION OF THE CORTEX OF THE VISUAL ANALYZER c52

N. I. Pityk *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 64-71 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 48-53 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

The experiments on diplacin-immobilized rats showed that stimulation of gastric and rectal mechanoreceptors caused noticeable changes in the control and light-induced impulse activity of neurons of the optic cortex. The predominant pattern of cell reactions were tonic changes of impulsation. They included both stimulatory and inhibitory effects. The latter occurred mostly as a result of stimulation of gastric mechanoreceptors. Changes in the evoked activity of those neurons involved most frequently enhancement or inhibition of responses, contrasting and stabilization of short-latent responses, and then masking with neuronal noise. The functional importance of the changes in the control and evoked activities of neurons of the optic cortex during interoceptive effects as well as possible central pathways of their realization in the optic cortex is discussed. R.E.S.

N80-17685# Joint Publications Research Service, Arlington, Va.

EFFECT OF ACUTE HYPOXIA ON SPECIFIC AND NONSPECIFIC SYSTEMS OF THE RABBIT BRAIN

N. S. Akopyan and O. G. Baklavadzhyan *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 72-78 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 53-57 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

Electrical activity of the brain under hypoxic activity was studied with the use of the EEG. At a simulated altitude of 8500-9000 m, an increase in the amplitude of the early positive and negative phase of the thalamic-cortical evoked potentials, and a slight prolongation of the latent period were seen. Changes in the reticulo-cortical and hypothalamo-cortical evoked potentials included a pronounced inhibition of their negative phase. In the EEG slow delta-waves increased gradually, becoming the major rhythm. The presence of EEG signs of the development of inhibitory processes in the cortex suggested that the changes in evoked potentials were also a result of inhibition of cortical neurons. Hypoxia-adapted rabbits tolerated acute hypoxia much better. They exhibited less pronounced changes in the electric manifestations of the function of specific and nonspecific projection systems of the brain. R.E.S.

N80-17686# Joint Publications Research Service, Arlington, Va.

STUDY OF BIOELECTRIC ACTIVITY OF NEURO-MUSCULAR AND SYMPATHETIC SYSTEMS DURING EXPOSURE TO A STEADY MAGNETIC FIELD c52

L. D. Klimovskaya and S. B. Krotova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 79-84 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 58-61 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

The experiments on an isolated frog neuromuscular preparation showed that an exposure to stable magnetic fields of 1000-4000 Oe did not influence the time parameters, amplitude and pattern of the action potentials of the gastrocnemius muscle induced by ischiatic nerve simulation with single impulses. Similar results were obtained from an analysis of electric responses of the upper cervical sympathetic node to the stimulation of preganglionar fibers in in situ experiments on urethane anesthesized rabbits subjected to a total exposure of a stable magnetic field (500-3000 Oe). In addition, an exposure to a stable magnetic field of 4000 Oe brought about a decrease of the level of depression of the action potential of muscles after conditioning tetanus. R.E.S.

N80-17687# Joint Publications Research Service, Arlington, Va.

EFFECTS OF STRONG INFRALOW-FREQUENCY MAGNETIC FIELDS ON BONE MARROW CELL DIVISION c52

A. D. Strzhizhovskiy, G. V. Galaktionova, and P. A. Cheremnykh *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 85-88 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 61-63 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

The effect of an infralow frequency field of 3-127 kOe applied for 1 hr on mitotic activity, frequency of chromosomal aberrations and number of bone marrow cells of mice was studied. The exposure of mice to fields of 3 and 8 kOe stimulated and to fields of 54 and 127 kOe inhibited mitotic activity. No increase in the frequency of aberrant mitoses in bone marrow cells was noted. The changes in the cell number were small (no more than 20 percent) and readily reversible. Author

N80-17688# Joint Publications Research Service, Arlington, Va.

PROGRAMMED CONTROL OF THE AUTOTROPHIC COMPONENT OF AN ECOLOGICAL SYSTEM THAT IS CLOSED WITH REGARD TO EXCHANGE OF GASES c52

A. S. Nasonov and V. S. Toroptsov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 89-95 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 63-68 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

The ecological system with closed gas exchange consisting of autotrophic and heterotrophic components located in different rooms was studied. The conditions of O2 and CO2 steady state with a periodically working autotrophic component were found. The stability of the steady-state was analyzed. Author

N80-17689# Joint Publications Research Service, Arlington, Va.

EFFECT OF CARBON MONOXIDE ON ANIMALS ADAPTED TO HYPOXIC HYPOXIA

V. V. Kustov and V. G. Litau *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 98-102 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 69-72 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

Experiments were conducted on 80 white male mice to investigate the development of carbon monoxide poisoning in animals adapted to hypoxic hypoxia. The following parameters were studied: body weight, hemoglobin and erythrocyte content of peripheral blood, blood catalase activity, blood peroxidase activity, and increment of carboxyhemoglobin. The results show that carbon monoxide in a concentration of 500 mg/cu m induces substantial changes in mice referable to several integral (body weight), hematological, and enzymatic parameters which are inherent in chronic carbon monoxide poisoning. R.E.S.

N80-17690# Joint Publications Research Service, Arlington, Va.

EFFECT OF STEADY MAGNETIC FIELD ON SOME ASPECTS OF ENERGY AND NITROGEN METABOLISM IN THE RAT CEREBRAL HEMISPHERES

Ye. A. Nosova and L. M. Kurkina *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 103-105 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 72-74 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

The effects of high intensity steady magnetic fields (SMF) on ammonia, glutamine, glutamic, aspratic and gamma-aminobutyric [GABA] acids were studied, as well as concentration levels of adenisine triphosphoric acid (ATP), phosphocreatine and lactic acid in the cerebral hemispheres of rats. Exposure of animals to SMF of 3000 Oe for 3 hours did not lead to reliable changes in levels of components of the glutamine-glutamic acid system, or in aspartic acid and GABA. The ATP content of brain tissue of rats exposed to SMF was reliably, though not markedly, decreased; phosphocreatine was unchanged, while lactic acid content was significantly increased. The decrease demonstrated in ATP content of the cerebral hemispheres to the bottom range of normal and increase in lactic acid to the top range of normal are indicative of greater activity of metabolic processes in the central nervous system of rats exposed to SMF, as compared to control animals. R.E.S.

N80-17691# Joint Publications Research Service, Arlington, Va.

EFFECT OF RHEOPOLYGLUCIN ON BLOOD CLOTTING FACTORS OF THE AORTA, MYOCARDIUM AND VENAE CAVAE DURING HYPOKINESIA c52

V. I. Inchina *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 106-110 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 74-76 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

The influence of low molecular dextrans on blood clotting and fibrinolytic properties of blood vessels and the myocardium under hypokinetic conditions was studied. The low molecular dextran used was rheopolyglucin. Constriction of the arteriolar lumen, dilatation of venules, appearance of recessed sacculations and increased capillary permeability were found in the myocardium of hypokinetic rabbits. These changes in the vascular wall, combined with demonstrated changes in the tissular system of hemostasis, lead to impairment of microcirculatory hemostasis. Rheopolyglucin, which normalizes the rheological properties of blood and diminishes aggregation of formed elements, improved microcirculation. However, complete restoration of circulation only occurred when capillaries were free of fibrin. R.E.S.

N80-17692# Joint Publications Research Service, Arlington, Va.

EFFECTS OF ACCELERATIONS ON THE EARLY STAGE OF RADIATION LESION IN ANIMALS

V. V. Antipov, D. N. Gavrilyuk, B. L. Razgovorov, and B. I. Davydov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 111-114 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), Vol. 14, No. 6, Nov./Dec. 1979 p 76-77 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

The influence of accelerations on the course of the body's primary reaction to the combined effect of accelerations and ionizing radiation was studied. The results of experiments on rats and dogs show that exposure to accelerations prior to radiation attenuates the primary reaction of both rats and dogs. Exposure to accelerations of irradiated animals induced effects in different directions: attenuation of gastro-intestinal tract disturbances at the early stage of radiation lesion in rats, and intensification of some manifestations of the primary reaction in dogs. R.E.S.

N80-17693# Joint Publications Research Service, Arlington, Va.

TEST IRRADIATION OF CHRONICALLY IRRADIATED DOGS FOR EVALUATION OF HEMOPOIETIC SYSTEM FUNCTION

T. Ye. Burkovskaya and B. A. Markelov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 115-119 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 78-80 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

In order to determine the severity of lesion and state of compensatory mechanisms of the hemopoietic system, acute irradiation was used as a used functional load. Male mongrel dogs were kept in a Co gamma field for 6 years. The results show functional deficiency of myeloid hemopoiesis in dogs submitted to long term chronic radiation; this deficiency was not demonstratable in ordinary morphological examinations of blood and bone marrow. The obtained results are indicative of a reduction in the bone marrow reserve of mature granulocytes, and this is more marked in dogs preirradiated in a dose of 1130 rad, as well as disturbances in the system of postradiation renewal of granulocyctes. Repair and compensatory-adaptive capabilities remain at a rather high level in the erythroid system. R.E.S.

N80-17694# Joint Publications Research Service, Arlington, Va.

INSOLUBLE COLLAGEN CONTENT OF DOG TISSUES AFTER EXPOSURE TO LOW DOSES OF CHRONIC GAMMA RADIATION

Z. A. Vinogradova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 120-122 Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 80-82 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

The effect of chronic irradiation on metabolism of collagen proteins was studied by assaying the insoluble collagen content of animal tissues at different stages of a chronic experiment. The results show a decrease in insoluble collagen content of organs and tissues (lungs, aorta, liver, tendon, cartilage and skin) of irradiated dogs as the accreted dosage increased. The results also show age-related changes with respect to collagen content. R.E.S.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-17695*# North Carolina State Univ., Raleigh. Neuropsychology Lab.

AROUSAL FROM SLEEP: THE UNIQUENESS OF AN INDIVIDUAL'S RESPONSE AND THE PROBLEM OF NOISE CONTROL Final Report

T. E. LeVere 1979 48 p refs
(Grant NGL-34-002-095)
(NASA-CR-162747) Avail: NTIS HC A03/MF A01 CSCL 06P

The dynamic nature of sleep is reviewed. Research is then presented concerning two fundamental issues: (1) does an individual react differently to auditory sounds when asleep as compared to when the individual is awake and (2) does sleep disruption necessarily involve behavioral awakening? R.E.S.

N80-17696*# General Electric Co., Hudson Falls, N.Y. Space Division.

BIOMEDICAL SYSTEMS ANALYSIS PROGRAM Final Report

31 Dec. 1979 72 p refs
(Contract NAS9-15487)
(NASA-CR-160456; TIR-741-LSP-9025) Avail: NTIS HC A04/MF A01 CSCL 06B

Biomedical monitoring programs which were developed to provide a system analysis context for a unified hypothesis for adaptation to space flight are presented and discussed. A real-time system of data analysis and decision making to assure the greatest possible crew safety and mission success is described. Information about man's abilities, limitations, and characteristic reactions to weightless space flight was analyzed and simulation models were developed. The predictive capabilities of simulation models for fluid-electrolyte regulation, erythropoiesis regulation, and calcium regulation are discussed. R.E.S.

N80-17697*# National Aeronautics and Space Administration, Washington, D. C.

SPACE FLIGHT RESEARCH RELEVANT TO HEALTH, PHYSICAL EDUCATION, AND RECREATION: WITH PARTICULAR REFERENCE TO SKYLAB'S LIFE SCIENCE EXPERIMENTS Final Report

Wayne D. VanHuss (Michigan State Univ., East Lansing) and William W. Heusner (Michigan State Univ., East Lansing) Jun. 1979 56 p refs
(NASA-EP-148) Avail: NTIS MF A01; SOD HC EP1.19:148 CSCL 06P

Data collected in the Skylab program relating to physiological stresses is presented. Included are routine blood measures used in clinical medicine as research type endocrine analyses to investigate the metabolic/endocrine responses to weightlessness. The daily routine of physical exercise, coupled with appropriate dietary intake, sleep, work, and recreation periods were considered essential in maintaining the crew's health and well being. M.M.M.

N80-17698# Research Inst. of National Defence, Linkoeping (Sweden).

IMPROVED PILOT TRAINING THROUGH MODIFICATION OF SELECTION AND TRAINING PROCEDURES

Leif Carlstedt Mar. 1979 15 p refs In SWEDISH; ENGLISH summary
(FOA-C-55029-H7) Avail: NTIS HC A02/MF A01

Modifications in selection procedures and training environment for military basic flight students have improved the ratio of selected to passed from .40 to .80 during the past decade. Applicants are screened in six stages. Test and assessment data are examined using the conjunctive multiple cutoff method. The selection process is a synthesis of characterlogical and compositional models. Changes in the training environment may cause loss of validity in some tests results. Author (ESA)

N80-17699# Istituto Superiore di Sanita, Rome (Italy). Lab. delle Radiazioni.

PROPOSED NATIONAL EXPOSURE LIMITS FOR MICROWAVE AND RADIOFREQUENCY RADIATION

G. Campos Venuti, M. Grandolfo, and G. Mariutti 31 Jan. 1979 100 p refs In ITALIAN; ENGLISH summary Presented at the Conv. Naz. dell' Assoc. Ital. di Fis. Sanitaria e Protezione Contro le Radiazioni, Rome, 30-31 Oct. 1978
(ISS-P-79/2) Avail: NTIS HC A05/MF A01

At present in Italy no statutory requirements or recommendations are enforced with respect to maximum permissible levels of microwave and radio frequency radiation to which either the general public or workers may be exposed. After a brief survey of current scientific data, a rationale for adopting permissible levels in the frequency range 100 kHz to 300 gHz is presented. Comparisons with other national and international standards are made. Author (ESA)

N80-17700# Istituto Superiore di Sanita, Rome (Italy). Lab. delle Radiazioni.

INTERCOMPARISON OF ISS AND BIPM PRIMARY EXPOSURE STANDARDS FOR MEDIUM ENERGY X-RAYS

E. Casnati (Inst. di Fis. dell' Univ., Ferrara, Italy), L. Pugliani, and P. Salvadori 26 Feb. 1979 58 p refs
(ISS-R-79/3) Avail: NTIS HC A04/MF A01

The primary exposure standards of the Istituto Superiore di Sanita and the Bureau International des Poids et Measures in the medium energy X-ray range were compared. After a description of the X-ray qualities on which the comparison was based, how the quantities appearing in the exposure definition were evaluated is explained and the aspects typical of the phenomenological realization of the exposure unit are listed. The properties of the X-ray beam, the correction factors applied to the free-air chamber measurements for obtaining the unit of exposure, the peculiarities and response of the transfer cavity chamber, and the calibration of the latter are discussed. The final results of the comparison are shown then compared with results reported by other laboratories. Author (ESA)

N80-17701# National Technical Information Service, Springfield, Va.

THE TOXICOLOGY OF OZONE. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Nov. 1979

Elizabeth A. Harrison Nov. 1979 132 p Supersedes NTIS/PS-78/1120
(PB80-800881; NTIS/PS-78/1120) Avail: NTIS HC $30.00/MF $30.00 CSCL 06T

The studies cited cover the toxic effects of ozone on humans, animals, and plants. Although many reports cite the effects of ozone generated as a photochemical oxidant from air pollution, others simply look at the basic biological effects of ozone without discussing its source. The topics described include ozone's effects on forests and agricultural crops, industrial exposure, maximum exposure levels, effects on microorganisms, and physiological effects. This updated bibliography contains 126 abstracts, 41 of which are new entries to the previous edition. GRA

N80-17702# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

THE SURVIVAL AND PROTECTION OF EQUIPMENT IN THE EVENT OF ACCIDENTAL IMMERSION IN COLD WATER

C. Boutelier Jan. 1979 125 p refs In FRENCH
(AGARD-AG-211-FR) Avail: NTIS HC A06/MF A01

The physiological reactions of the human body to thermal aggression and eventual pathological incidences and their treatment are described for airmen and designers of equipment designed for protecting pilots against cold water following accidental immersion. Topics covered include: (1) heat transfer from the human body in ambient cold by conduction, convection, evaporation, and radiation; (2) the physiological response to immersion - tolerance and acclimatization; (3) diagnosis and treatment of local and general effects of cold, including hypothermia; (4) the theoretical basis for protective clothing; (5) methods for evaluating protective clothing; and (6) the design and construction of anti-immersion equipment: wet suits, dry suits, life vests, and lifeboats. Transl. by A.R.H.

N80-17675# Joint Publications Research Service, Arlington, Va.

SOME PHILOSOPHICAL ASPECTS OF THE PROBLEM OF MAN, THE BIOSPHERE AND SPACE

N. A. Agadzhanyan *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 1-8 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 1-9 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17676# Joint Publications Research Service, Arlington, Va.

COMPOSITION OF INTESTINAL MICROFLORA OF COSMONAUTS BEFORE AND AFTER SPACE FLIGHTS

N. N. Lizko, V. M. Shilov, G. D. Syrykh, and V. I. Legenkov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 9-20 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 9-13 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17679# Joint Publications Research Service, Arlington, Va.

EFFECTS OF MINIMAL GRAVITATIONAL LOADS ON FLUID-ELECTROLYTE METABOLISM AND RENAL FUNCTION OF MAN DURING PROLONGED IMMERSION

A. I. Grigoryev and Ye. B. Shulzhenko *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 33-39 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 27-31 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17680# Joint Publications Research Service, Arlington, Va.

CREATINURIA IN MAN DURING PROLONGED HYPOKINESIA

S. A. Kamforina *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p40-44 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 32-35 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17681# Joint Publications Research Service, Arlington, Va.

CHANGES IN THE NEUROMOTOR SYSTEM DURING 45 DAYS OF HYPOKINESIA

Ye. A. Shaposhnikov, P. I. Sidorov, and A. I. Kolomenskiy *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 45-51 refs Transl. into ENGLISH from Kosmich. Biol. Aviatkomich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 35-39 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17682# Joint Publications Research Service, Arlington, Va.

ELECTROSTIMULATION OF MUSCLES FOR THE PREVENTION OF NEUROMUSCULAR DISORDERS DURING 45-DAY ANTIORTHOSTATIC HYPOKINESIA

V. S. Georgiyevskiy, Ye. A. Ilinskaya, V. I. Matveyev, V. M. Mikhaylov, and V. I. Pervushin *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 52-57 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 40-44 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17683# Joint Publications Research Service, Arlington, Va.

EFFECT OF VESTIBULAR STIMULI ON VISUAL TRACKING IN A LIMITED TRACKING AREA

V. I. Babiyak, Yu. N. Kholodov, and Yu. K. Yanov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 58-63 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov/Dec. 1979 p 49-48 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17684# Joint Publications Research Service, Arlington, Va.

ROLE OF INTEROCEPTIVE AFFERENTATION IN FUNCTION OF THE CORTEX OF THE VISUAL ANALYZER

N. I. Pityk *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 64-71 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 48-53 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17685# Joint Publications Research Service, Arlington, Va.

STUDY OF BIOELECTRIC ACTIVITY OF NEURO-MUSCULAR AND SYMPATHETIC SYSTEMS DURING EXPOSURE TO A STEADY MAGNETIC FIELD

L. D. Klimovskaya and S. B. Krotova *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 79-84 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 58-61 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17687# Joint Publications Research Service, Arlington, Va.

EFFECTS OF STRONG INFRALOW-FREQUENCY MAGNETIC FIELDS ON BONE MARROW CELL DIVISION

A. D. Strzhizhovskiy, G. V. Galaktionova, and P. A. Cheremnykh *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 85-88 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 61-63 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17688# Joint Publications Research Service, Arlington, Va.

PROGRAMMED CONTROL OF THE AUTOTROPHIC COMPONENT OF AN ECOLOGICAL SYSTEM THAT IS CLOSED WITH REGARD TO EXCHANGE OF GASES

A. S. Nasonov and V. S. Toroptsov *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 89-95 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 63-68 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

N80-17691# Joint Publications Research Service, Arlington, Va.

EFFECT OF RHEOPOLYGLUCIN ON BLOOD CLOTTING FACTORS OF THE AORTA, MYOCARDIUM AND VENAE CAVAE DURING HYPOKINESIA

V. I. Inchina *In its* USSR Rept.: Space Biol. and Aerospace Med., Vol. 14, No. 6, 1979 (JPRS-75041) 31 Jan. 1980 p 106-110 refs Transl. into ENGLISH from Kosmich. Biol. Aviakosmich. Med. (Moscow), vol. 14, no. 6, Nov./Dec. 1979 p 74-76 (For primary document see N80-17674 08-51)
Avail: NTIS HC A06/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-17703# Research Inst. of National Defence, Linkoeping (Sweden)

COMPENSATORY AND CONJUNCTIVE PROCESSING OF TEST INFORMATION FOR PREDICTION OF RESULTS OF MILITARY FLIGHT TRAINING [KOMPENSATORISK OCH KONJUNKTIV BEHANDLING AV TESTINFORMATION FOER PREDIKTION AV RESULTAT PAA MILITAAR FLYGUTBILDNING]
Leif Carlstedt Mar. 1979 28 p refs In SWEDISH
(FOA-C-55025-H7) Avail: NTIS HC A03/MF A01

Data collected during aircraft pilot selection tests were analyzed by two different methods to determine the predictive ability of each to military flight training. The comparison was made using data from four groups using a compensatory and a conjunctive method. The conjunctive or cross validation method gave better predictions in three of the four groups, but the compensatory or regression analysis method gave better results in the fourth group. Author (ESA)

N80-17704# Research Inst. of National Defence, Linkoeping (Sweden).
STEPWISE PILOT SELECTION: PROCEDURE AND VALIDITY [STEGVIST URVAL AV FLYGFOERARE: PROCEDUR OCH VALIDITET]
Leif Carlstedt Mar. 1979 18 p refs In SWEDISH
(FOA-C-55026-H7) Avail: NTIS HC A02/MF A01

A graduated selection method used since 1970 to select Swedish military pilots is described and compared with previous practice. Formerly, all test data were weighted equally at all stages of the selection process, but now the data are quantified by an expectancy hypothesis at the beginning of the selection process. Also, the personality test defense mechanism test has been introduced as a selection instrument. Using the graduated or stepwise method has improved the selection rate from 45 to 56 men trained per 20 selected, to 41 men trained per 20 selected. Author (ESA)

N80-17705# Research Inst. of National Defence, Linkoeping (Sweden).
THE INFLUENCE OF THE CHANGE OF FLIGHT INSTRUCTION AND HIS ABILITY UPON THE PUPIL'S ADAPTATION TO FLYING [INVERKAN AV FLYGLAERARBYTGN OCH FLYGLAERARENS KVALITET PAA ELEVENS ANPASSNING TILL FLYGNING]
Leif Carlstedt Mar. 1979 20 p refs In SWEDISH
(FOA-C-55027-H8) Avail: NTIS HC A02/MF A01

The importance of the frequency of the changes of flight teacher and of his quality on the pupil's adaptation to flying is studied. It is shown that students having fewer than five flying tests with the same teacher during the 20 first flying hours are expected to fail more often than those who have more than five with the same teacher. The pupil's adaptation to flying (measured by a questionaire) is related to the improvements made at the beginning of the training period. In most cases students adapting well have had teachers rated as good in the flying school. Author (ESA)

N80-17706# Research Inst. of National Defence, Linkoeping (Sweden).
IMPROVED FLIGHT TRAINING METHODS [OPERATION KVALITETSHOEJNING AV FLYGFOERARPRODUKTIONEN]
Leif Carlstedt and F. Paul Johansson Mar. 1979 49 p refs In SWEDISH
(FOA-C-55028-H8) Avail: NTIS HC A03/MF A01

The evolution of methods used in military pilot training is presented along with a discussion and evaluation of Swedish practices. An experiment is described in which the trainee group is given a distinctive name and exposed to a training cadre which was highly motivated at all levels of command. The long term project showed increases in pilot selection success ratio. Author (ESA)

N80-17707# National Technical Information Service, Springfield, Va.
INFORMATION PROCESSING IN HUMANS, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Nov. 1977 - Nov. 1979
Elizabeth A. Harrison Nov. 1979 123 p supersedes NTIS/PS-78/1154; NTIS/PS-77/1042; NTIS/PS-76/0947; NTIS/PS-75/858; NTIS/PS-75/087
(PB80-800931; NTIS/PS-78/1154; NTIS/PS-77/1042; NTIS/PS-76/0947; NTIS/PS-75/858; NTIS/PS-75/087) Avail: NTIS HC $30.00/MF $30.00 CSCL 05J

Psychophysiology, memory, visual evoked responses, psychoacoustics, neuroses, decision making and learning, as related to information processing in humans, are topics covered by the selected abstracts of research reports. This updated bibliography contains 118 abstracts, 64 of which are new entries to the previous edition. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-17708*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED REMOTE WORK STATION DEVELOPMENT ARTICLE, EXECUTIVE SUMMARY Final Report
1 Mar. 1979 69 p
(Contract NAS9-15507)
(NASA-CR-160462; NSS-MR-RP008) Avail: NTIS HC A04/MF A01 CSCL 05H

The mission requirements for the manned remote work station (MRWS) flight article and the manned remote work station open cherry picker development test article is defined. Considerations are given for the near, mid, and far term use of the MRWS with emphasis on its ultimate application: constructing the Solar Power Satellite. R.C.T.

N80-17709*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED REMOTE WORK STATION DEVELOPMENT ARTICLE. VOLUME 1, BOOK 1: FLIGHT ARTICLE REQUIREMENTS. APPENDIX A: MISSION REQUIREMENTS Final Report
1 Mar. 1979 317 p
(Contract NAS9-15507)
(NASA-CR-160463; NSS-MR-RP008-Vol-1-Book-1) Avail: NTIS HC A14/MF A01 CSCL 05H

The requirements for several configurations of flight articles are presented. These requirements provide the basis to design manned remote work station development test articles and establish tests and simulation objectives for the resolution of development issues. Mission system and subsystem requirements for four MRWS configurations included: open cherry picker; closed cherry picker; crane turret; and free flyer. R.C.T.

N80-17710*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED REMOTE WORK STATION DEVELOPMENT ARTICLE. VOLUME 1, BOOK 2, APPENDIX B: TRADE AND DESIGN DEFINITION STUDIES Final Report
1 Mar. 1979 201 p
(Contract NAS9-15507)
(NASA-CR-160464; NSS-MR-RP008-Vol-1-Book-2) Avail: NTIS HC A10/MF A01 CSCL 05H

System trades, evaluations, and selection were organized under the appropriate manned remote work station roles and subsystems. Those trades/evaluations that have an impact on simulator fidelity were given emphasis in terms of identifying alternate concepts, making a selection, and defining the system approach. Those trades that do not impact simulator fidelity have the issues delineated and future study requirements identified. R.C.T.

N80-17711*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED REMOTE WORK STATION DEVELOPMENT ARTICLE. VOLUME 2: SIMULATION REQUIREMENTS. APPENDIX A: OPEN CHERRY PICKER DEVELOPMENT TEST ARTICLES SPECIFICATION Final Report
1 Mar. 1979 132 p
(Contract NAS9-15507)
(NASA-CR-160465; NSS-MR-RP008-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 05H

A manned remote work station (MRWS) mission scenario, broken down into the three time phases was selected as the basis for analysis of the MRWS flight article requirements and concepts. The mission roles for the three time phases, supporting tradeoff and evaluation studies, was used to identify key issues requiring simulation. The MRWS is discussed in terms of its capability to perform such operations as support of Spacelab experiments, servicing and repair of satellites, and construction. Future considerations for the use of the MRWS are also given.
R.C.T.

N80-17712*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED REMOTE WORK STATION DEVELOPMENT ARTICLE. VOLUME 3: DEVELOPMENT TEST PLAN. APPENDIX A: MANUFACTURING REQUIREMENTS/SCHEDULE Final Report
1 Mar. 1979 180 p
(Contract NAS9-15507)
(NASA-CR-160466; NSS-MR-RP008-Vol-3) Avail: NTIS HC A09/MF A01 CSCL 05H

The tests and procedures for the manned remote work station (MRWS) open cherry picker (OCP) development test article (DTA) are described to validate systems requirements and performance specifications. A development test program is outlined to evaluate key design issues and man/machine interfaces when the MRWS OCP is used in a shuttle support role of satellite servicing and in orbit construction of large structures. R.C.T.

N80-17713# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
REFERENCE TREE NETWORKS: VIRTUAL MACHINE AND IMPLEMENTATION Ph.D. Thesis
Robert Hunter Halstead, Jr. 2 Jul. 1979 250 p refs
(Contract N00014-75-C-0661)
(AD-A076570; MIT/LCS/TR-222) Avail: NTIS HC A11/MF A01 CSCL 05/8

A current-technology computing machine may be roughly decomposed into a processor, a memory, and a data path connecting them. The interposition of this data path between processing and storage elements creates a bottleneck which inhibits progress at the high-performance end of the technological spectrum. Additionally, the monolithic nature of present-day processors resists incremental addition or removal of processing power. The research described here attacks the problem of constructing more powerful and more flexible computer systems along three fronts: the definition of a virtual machine providing for parallel computation using objects and object references, the development of a distributed implementation mechanism ('reference trees') supporting object management functions including garbage collection, and the investigation of scheduling algorithms and collection of performance results. A reference tree network using these concepts is composed of a multiple of independent small processors, yet operates as a coherent programming system. Programs and data spread automatically and transparently through the network to occupy underused resources. The modular structure of the network provides many parallel data paths as well as allowing for easy addition or removal of modules, thus addressing some of the problems discussed here. A prototype reference tree network, the Mu Ner, is currently in operation. GRA

N80-17714# Human Resources Research Organization, Alexandria, Va.
EFFECTS OF FATIGUE FROM WEARING THE AN/PVS-5 NIGHT VISION GOGGLES ON SKILLS INVOLVED IN HELICOPTER OPERATIONS Technical Report, 13 May - 29 Dec. 1978
Garvin D. Chastain and Albert L. Kubala Jul. 1979 51 p refs
(Contract MDA907-78-C-2017; DA Proj. 2Q7-63743-A-775)
(AD-A075426; HUMRRO-FR-WD-TX-78-18; ARI-RR-1217) Avail: NTIS HC A04/MF A01 CSCL 06/17

Reviews of the literature on rotary wing flight and interviews with aviators were conducted to determine which helicopter tasks and maneuvers are performed most frequently and/or are the most critical. Those operations found to be most critical were analyzed into perceptual and psychomotor components, and a battery of perceptual and psychomotor tests was selected to measure these factors. Aviators were tested both before and after flying with the AN/PVS-5 goggles. Eye-hand coordination was marginally affected following flight, and reaction time to lights was significantly affected. GRA

N80-17715# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
THE VISUAL SCENE PERCEPTION PROCESS INVOLVED IN MANUAL APPROACH LANDING
P. H. Wewerinke 13 Oct. 1978 87 p refs
(Contract NIVR-1857)
(NLR-TR-78130-U) Avail: NTIS HC A05/MF A01

The outside scene is often an important source of information for manual control tasks. In the context of aircraft control the most importance example is the visual approach scene. Modeling the visual scene perception process on the basis of linear perspective geometry and relative motion cues is dealt with. Its impact on aircraft approach performance is investigated. Model predictions utilizing visual threshold data from baseline experiments and psychophysical literature of a variety of visual approach tasks are compared with the results of an experimental program. The results confirm that the visual scene may be assumed to provide a variety of cues among which the human operator has to divide his attention. Both the performance and workload results illustrate that the model provides a meaningful description of the outside world perception process with a useful predictive capability. Additional research, however, is warranted in order to be able to deal with the realistic, complex, time varying manual approach and landing situation. Author (ESA)

N80-17716# Massachusetts Inst. of Tech., Cambridge.
SUPERMAN: A SYSTEM FOR SUPERVISORY MANIPULATION AND THE STUDY OF HUMAN/COMPUTER INTERACTIONS M.S. Thesis
Thurston L. Brooks and Thomas B. Sheridan Jul. 1979 286 p refs
(Contract N00014-77-C-0256; Grant NOAA-04-7-158-44079)
(PB-301290/3; MITSG-79/20; NOAA-79082405) Avail: NTIS HC A13/MF A01 CSCL 13J

The need for supervisory control of remote teleoperator vehicles in the ocean environment is considered and it is shown that computer controlled systems can increase the effectiveness of remote manipulation. A distinction is made between absolute tasks--tasks which have a known spatial relationship to the manipulator base prior to execution--and relative tasks-tasks which cannot be spatially defined prior to execution. Based on the mathematical and theoretical foundations described, a supervisory system was developed and demonstrated. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N80-17717*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN ASSESSMENT OF FUTURE COMPUTER SYSTEM NEEDS FOR LARGE-SCALE COMPUTATION
Peter Lykos and John White Feb. 1980 57 p Prepared in cooperation with Illinois Inst. of Tech., Chicago
(NASA-TM-78613; A-7929) Avail: NTIS HC A04/MF A01 CSCL 09B

Data ranging from specific computer capability requirements to opinions about the desirability of a national computer facility are summarized. It is concluded that considerable attention should be given to improving the user-machine interface. Otherwise, increased computer power may not improve the overall effectiveness of the machine user. Significant improvement in throughput requires highly concurrent systems plus the willingness of the user community to develop problem solutions for that kind of architecture. An unanticipated result was the expression of need for an on-going cross-disciplinary users group/forum in order to share experiences and to more effectively communicate needs to the manufacturers. K.L.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering.*

N80-17718 California Univ., Berkeley.
THE EFFECTS OF CONCURRENCY CONTROL OF THE PERFORMANCE OF DATABASE MANAGEMENT SYSTEMS Ph.D. Thesis
Daniel Roland Ries 1979 218 p
Avail: Univ. Microfilms Order No. 8000487

The performance tradeoffs between parallelism and increased concurrency control overhead during simultaneous user updates of a database are studied using simulation models. The results indicate that in many cases coarse granularity such as file, relation, or record type locking is preferable. However, if all of the updates are small and randomly access the database, finer granularity, such as page or record locking becomes necessary. If the sizes and access patterns of updates vary considerably, a lock hierarchy with different sized locks is beneficial. The simulation results also indicate that with a high speed network and mostly local database activities, either primary site control or decentralized control algorithms are acceptable. As the network becomes slower, the decentralized control algorithms are preferable. If most of the database activities are distributed, however, the primary site approach can take advantage of its global knowledge to better schedule the processing of transactions and thus provide better performance than the decentralized algorithms. Dissert. Abstr.

N80-17719 Texas Univ. at Austin.
HARDWARE SUPPORT FOR MODERN SOFTWARE CONCEPTS Ph.D. Thesis
Charles George Hoch 1978 153 p
Avail: Univ. Microfilms Order No. 7928374

A realizable machine architecture which straightforwardly supports program modularity, typing and abstract data objects, concurrency, recursion, and program recovery/restart is described and defined. The proposed architecture is obtained through a unifying synthesis and formalization of existing hardware concepts. The key conceptual elements of the design are the integration of the concepts of typing, capabilities, word tagging, and memory virtualization, and the uniform treatment of hardware instructions, software functions, and device actions. The practicality of the architecture is demonstrated by using a software realization of it as an intermediate target language for the implementation of GYPSY, a language which includes all of the concepts of modern software mentioned above. Dissert. Abstr.

N80-17720 Texas Univ. at Austin.
LOCKING MECHANISMS FOR CONCURRENCY CONTROL AND CONSISTENCY IN DATA BASE SYSTEMS Ph.D. Thesis
Sukho Lee 1979 166 p
Avail: Univ. Microfilms Order No. 7928321

Locking mechanisms, structural locking and semantic locking, are developed to control concurrency and maintain data base consistency. The structural locking mechanism allows precise specification of the locked data objects and thus can afford maximal concurrency via the realization of minimal locking. The set-oriented conflict test associated with the mechanism is simple and effective. Furthermore, when associative memories are in common use in data base machines, structural locking has unique characteristics to take advantage of this architecture. Semantic locking provides a mechanism for maintaining consistency between semantically dependent data objects in concurrency environment. The mechanism allows a system to enforce the appropriate consistency constraints when constraining data are updated. Dissert. Abstr.

N80-17721 Ohio State Univ., Columbus.
A MINICOMPUTER-MULTIPLE MICROPROCESSOR SYSTEM FOR GAIT ANALYSIS USING TELEVISION AND FORCE PLATE DATA Ph.D. Thesis
Hoover J. Chen 1979 407 p
Avail: Univ. Microfilms Order No. 8001707

A minicomputer multiple microprocessor system which is capable of processing the video information from three television cameras placed at different locations was developed. The system detects the positions of lights attached to various human joints. Spatial coordinate information from the television is acquired simultaneously without the loss of data through the parallel microprocessor architecture. The multiple microprocessor interface module functioning as the front-end device for the master PDP-11/34 computer allows each camera to be handled by its own dedicated microprocessor. Interactive software programs for data sorting, smoothing, and processing are written in such a way thay they can be executed by nontechnical personnel. Dissert. Abstr.

N80-17722* Systems Technology, Inc., Mountain View, Calif.
THE ANALYSIS OF DELAYS IN SIMULATOR DIGITAL COMPUTING SYSTEMS. VOLUME 1: FORMULATION OF AN ANALYSIS APPROACH USING A CENTRAL EXAMPLE SIMULATOR MODEL Final Report
Robert K. Heffley, Wayne F. Jewell, Richard F. Whitbeck, and Ted M. Schulman Feb. 1980 101 p refs
(Contract NAS2-10106)
(NASA-CR-152340; STI-TR-1140-1-Vol-1) Avail: NASA Ames Res. Center, Moffett Field, Calif. 94035 CSCL 09B

The effects of spurious delays in real time digital computing systems are examined. Various sources of spurious delays are defined and analyzed using an extant simulator system as an example. A specific analysis procedure is set forth and four cases are viewed in terms of their time and frequency domain characteristics. Numerical solutions are obtained for three single rate one- and two-computer examples, and the analysis problem is formulated for a two-rate, two-computer example. K.L.

N80-17723*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
SMOOTHING FILTER FOR DIGITAL TO ANALOG CONVERSION Patent
Charles A. Wagner, inventor (to NASA) Issued 25 Jan. 1980 16 p
(NASA-Case-FRC-11025-1; US-Patent-Appl-SN-115536) Avail: NTIS HC A02/MF A01 CSCL 09B

An electronic filter comprised of three active filter sections (A, B, C) is provided to smooth the stepped signal from a digital to analog converter. The first section has a noninverting low pass filter transfer function, and the second has an inverting transfer function designed to pass a narrow frequency band centered at the step frequency of the stepped output signal with sharp cutoff on either side of that narrow band. The third section adds the noninverted output of the first section to the inverted output of the second section. This third section has a lead lag transfer function designed to reduce the phase angle between the signal at its output terminal and the stepped signal at the input of the first section. NASA

N80-17724# General Research Corp., McLean, Va. Operations Analysis Group.
ANALYSIS TO DETERMINE FUNCTIONAL AND SYSTEMS REQUIREMENTS FOR AN ON-LINE AND COMPOSITION SYSTEM (SACS). REPORT OF TASK G NEAR- AND LONG-TERM IMPROVEMENTS Final Report, period ending Aug. 1979
Francis O. Deppner, John J. Anderson, and Whitney C. Scully Sep. 1979 123 p
(Contract MDA903-78-C-0445)
(AD-A076019; GRC-1070-06-79-CR; Avail: NTIS

HC A07/MF A01 CSCL 09/2

This report identifies specific improvement actions required to bring an improved on-line SACS to fruition. The actions have been further broken into subtasks, dependency relationships have been established, and tasks have been identified as being either near-term (1-12 months) or long-term (up to 32 months). The report also contains a network schematic which portrays the sequence in which the SACS improvement work should be accomplished during the full 32 months of effort. GRA

N80-17725# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
RESULTS OF GEOTECHNICAL COMPUTER USAGE SURVEY Final Report
David P. Hammer and Robert D. Bennett Aug. 1979 47 p refs
(AD-A073826; WES-MP-GL-79-19) Avail: NTIS HC A03/MF A01 CSCL 09/2

Recognizing a need for improving automatic data processing (ADP) capabilities in the geotechnical field, the Office, Chief of Engineers, requested the U.S. Army Engineer Waterways Experiment Station to conduct a study to determine if geotechnical elements in the Corps of Engineers (CE) thought an upgrading of their ADP capabilities was needed and, if so, exactly what type of effort would be most beneficial. The first phase of this study consisted of a survey of various representative CE District and Division offices to investigate the state of the art in computer usage among CE geotechnical elements and compile what they considered to be their greatest needs. This report presents the results of that study. Based on the results of this survey, an upgrading in the area of geotechnical computer applications is apparently needed and desired by the majority of CE District and Division offices. Efforts toward accomplishing this should be directed toward increasing capabilities in the areas of (1) data-base management; (2) interactive graphics and plotting; and (3) technology transfer. GRA

N80-17726# General Accounting Office, Washington, D. C.
SPERRY UNIVAC EXEC-8 OPERATING SYSTEM
Oct. 1979 92 p
(PB80-101702; CCVS74-VSR430) Avail: NTIS HC A05/MF A01 CSCL 09B

The results obtained from the the validation of the Sperry Univac 1100 series COBOL Compiler Version 4R2A (EXEC-8 Version 36R10C) against the 1974 COBOL Standard (X3.23-1974/FIPS PUB 21-1) are summarized. The compiler was validated at the HIGH level of FIPS PUB 21-1. An overview of the validation which lists all categories of discrepancies by level/module within X3.23-1974 and a section relating the categories of discrepancies to each of the Federal levels of the language are presented together with a detailed listing of discrepancies and the tests which were failed. GRA

N80-17727# General Accounting Office, Washington, D. C.
NCR CORPORATION, IMOS COBOL VERSION 04.03.04
16 Oct. 1979 68 p
(PB80-102361; CCVS74-VSR460) Avail: NTIS HC A04/MF A01 CSCL 09B

A consolidated summary of the results obtained from the validation of the subject compiler against the 1974 COBOL Standard (X3.23-1974/FIPS PUB 21-1) is presented. The compiler was validated at the LOW INTERMEDIATE level of FIPS PUB 21-1. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies by level/module within X3.23-1974, a section relating the categories of discrepancies to each of the Federal levels of the language and a detailed listing of discrepancies together with the tests which were failed. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-17728 Stanford Univ., Calif.
PERFORMANCE OF UPDATE ALGORITHMS FOR REPLICATED DATA IN A DISTRIBUTED DATABASE Ph.D. Thesis
Hector Garcia-Molina 1979 319 p
Avail: Univ. Microfilms Order No. 8001920

Studies are presented on the performance of update algorithms for replicated data in a distributed database. In doing so, several other related issues are investigated. A simple model of a distributed database which is suitable for studying updates and concurrency control are presented. A performance model and a set of parameters which represent the most importance performance features of a distributed database are developed. Dissert. Abstr.

N80-17729 California Univ., Berkeley.
ON DESIGN AND VERIFICATION OF PROGRAM MODULES FOR RESOURCE SHARING Ph.D. Thesis
Wu-Hon Francis Leung 1979 189 p
Avail: Univ. Microfilms Order No. 8000417

Methods for the specification, design, and verification of program modules which allow more than one process to execute their procedures at the same time are presented. For the purpose of specifying these program modules, a method to construct their state space is given. The procedures of a program module are organized according to a design protocol so that when a process executes the program module, it follows the steps specified by the protocol. For program modules so designed, sufficient conditions to avoid interfering situations are established. A mechanism called a synchronization queue is proposed to be used in a program module to satisfy these conditions. Techniques to verify the partial correctness of these program modules are developed and methods to reduce the effort in verification are given. Conditions to show the absence of infinite loops, total blocking, permanent blocking, and starvation of an individual process in a program module are also derived. Dissert. Abstr.

N80-17730# Arizona Univ., Tucson. Dept. of Aerospace and Mechanical Engineering.
DIGITIZING FOR COMPUTER-AIDED FINITE ELEMENT MODEL GENERATION
H. A. Kamel and Z. Navabi 10 Oct. 1979 35 p
(Contract N00014-75-C-0837)
(AD-A076573; TR-5) HC A03/MF A01 CSCL 13/13

For the purpose of this paper, computer aided design is acknowledged as being a complex process involving many disciplines. This paper describes an approach to a specific discipline, that of structural analysis, which has evolved with the design process in mind. The vehicle for the implementation of this approach is a collection of programs developed over the last eight years at the University of Arizona, and called the GIFTS system. This paper briefly describes the latest version of the system, GIFTS-5, and demonstrates its suitability in a design environment by simple examples. The programs constituting the GIFTS system were used as a tool for research in many areas, including mesh generation, finite element data base design, interactive analysis, numerical analysis, as well as digitization. The last sections describe a newly developed digitizing program aimed at facilitating the preparation of input describing complex two-dimensional models for the GIFTS mesh generator. Modern analysis methods, of which the finite element is a prime example, permit the engineer to analyze most types of structures under a variety of loads. Although this is valid in principle, many practical considerations are involved which may influence the desirability and practicality of a computer analysis. GRA

N80-17731# Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.
MUTATION ANALYSIS Final Report
Allen T. Acree, Timothy A. Budd (Yale Univ., New Haven, Conn.), Richard A. DeMillo, Richard J. Lipton (Calif. Univ., Berkeley), and Frederick G. Sayward (Yale Univ., New Haven, Conn.) Sep. 1979 90 p refs
(Contract N00014-79-C-0231; Grant DAAG29-78-G-0121)
(AD-A076575; GIT-ICS-79/08; ARO-15950.4-A-EL) Avail: NTIS HC A05/MF A01 CSCL 09/2

A new type of software test, called mutation analysis, is introduced. A method of applying mutation analysis is described, and the design of several existing automated systems for applying mutation analysis to FORTRAN and COBOL programs is sketched. These systems have been the means for preliminary studies of the efficiency of mutation analysis and of the relationship between mutation and other systematic testing techniques. The results of several experiments to determine the effectiveness of mutation analysis are described, and examples are presented to illustrate the way in which the technique can be used to detect a wide class of errors, including many previously defined and studied in the literature. Finally, a number of empirical studies are suggested, the results of which may add confidence to the outcome of the mutation analysis of a program. GRA

N80-17732# Stanford Univ., Calif. Dept. of Computer Science.

A SYMMETRIC CHAIN DECOMPOSITION OF L(4,N)

Douglas B. West Aug. 1979 18 p refs
(Contract N00014-76-C-0688; Grant MCS-77-23738)
(AD-A076876; SU-STAN-CS-79-763) Avail: NTIS HC A02/MF A01 CSCL 12/1

Let L(m,n) be the set of integer m-tuples (a sub i, ..., a sub m), with 0 < or = a sub i < or = n, ordered by a < or = b when a sub i < or = b sub i for all i. It is shown that L(m,n) is a symmetric chain order for all (m,n) by construction for m = 4. K.L.

N80-17733# George Washington Univ., Washington, D. C. Inst. for Management Science and Engineering.

BASIC RESULTS IN THE DEVELOPMENT OF SENSITIVITY AND STABILITY ANALYSIS IN CONSTRAINED MATHEMATICAL PROGRAMMING

Anthony V. Fiacco and William P. Hutzler 7 Aug. 1979 51 p refs
(Contract DAAG29-79-C-0062)
(AD-A076486; SERIAL-T-407; ARO-16229.1-M) Avail: NTIS HC A04/MF A01 CSCL 12/1

For large classes of mathematical programming problems, a detailed technical survey is given of key developments in sensitivity and stability analysis results, i.e., results characterizing the relationship between the optimal value function or a solution set and problem perturbations. The emphasis is on finite dimensional nonlinear problems with deterministic parametric perturbations. Precise assumptions and conclusions of key results are given in the more than 30 theorems that are stated. Some effort has been made to unify the notation and terminology and to place the results in perspective. Directions of future research and applications are indicated. Finally, an extensive bibliography is included. The paper is motivated by a desire to unify into one body of theory the many penetrating results that are now known in this crucially important area. GRA

N80-17734# SRI International Corp., Menlo Park, Calif.

A JOVIAL VERIFIER Interim Report, 14 Nov. 1977 - 31 Dec. 1978

B. Elspas, M. W. Green, M. S. Moriconi, and R. E. Shostak Jul. 1979 78 p refs
(Contract F30602-78-C-0031; AF Proj. 2532)
(AD-A075108; SRI-6977-1; RADC-TR-79-195) Avail: NTIS HC A05/MF A01 CSCL 09/2

This Interim Report describes progress during the first year of research and development on a program verification system supporting the design, development, and formal verification of programs written in JOVIAL-J73-I. The work reported here represents an outgrowth and continuation of earlier efforts concerned with JOVIAL-J3 (JOCIT version). Detailed descriptions are presented of progress and future plans in the following areas: (a) Analysis of the JOVIAL-J73/I language with respect to verifiability, leading to formal definitions of its syntax and semantics, and to the enhancement of the language by assertion constructs for the purposes of specification; and verification (b) The organization, technical development, and implementation of portions of the JOVIAL Verifier - in particular, of a verification condition generator and deductive subsystems; (c) The selection, analysis, and verification of two real software systems of significant size and complexity, critical parts of which will be implemented in J73/I and which is hoped to be verified by means of the JOVIAL Verifier. GRA

N80-17735# Honeywell Information Systems, Inc., Minneapolis, Minn.

RATIONALE FOR THE DESIGN OF THE GREEN PROGRAMMING LANGUAGE, A LANGUAGE DESIGNED IN ACCORDANCE WITH THE STEELMAN REQUIREMENTS

15 Mar. 1979 266 p refs Prepared in cooperation with CII Honeywell Bull, Louveciennes, France
(Contract MDA903-77-C-0331; ARPA Order 3341)
(AD-A073662) Avail: NTIS HC A12/MF A01 CSCL 09/2

This document, the rationale for the design of the GREEN programming language, and the companion Reference Manual, are the two defining documents for the GREEN language. They serve different purposes. The Reference Manual contains a complete and concise definition of the language. Following Wirth we believe in the virtue of having a rather short reference manual. This has the advantage of providing the information in a form that can easily be consulted, read and reread several times, as the basis for developing a good familiarity with the language. GRA

N80-17736# Honeywell Information Systems, Inc., Minneapolis, Minn.

THE GREEN LANGUAGE: A FORMAL DEFINITION

Apr. 1979 113 p Prepared in cooperation with CII Honeywell Bull, Louveciennes, France
(Contract MDA73-77-C-0331)
(AD-A073714) Avail: NTIS HC A06/MF A01 CSCL 09/2

This document is a Preliminary Draft of the Formal Definition of the GREEN Programming Language. As such, it indicates the structure and style of the final document. At this stage, the Static Semantics is well advanced but not complete, and large parts of the Dynamic Semantics are missing. Some sections (such as Chapter 4 - 6) have been worked on in detail to give a better idea of the final shape of the Formal Definition. GRA

N80-17737# Argonne National Lab., Ill.

FIC: A FINITE ELEMENT CODE FOR CALCULATING ADDED MASS AND DAMPING COEFFICIENTS: USER'S MANUAL

S. M. Batill Jul. 1979 59 p refs
(Contract W-31-109-eng-38)
(ANL-CT-79-46) Avail: NTIS HC A02/MF A01

A user manual is presented for a code capable of calculating the hydrodynamic reactions on multiple interacting bodies undergoing simple harmonic motion. Input requirements are documented and the program output is described. A sample data set and program listing are also included. It should be noted that the program is not prepared for production applications but is intended for use as a research tool. DOE

N80-17738# Research Inst. of National Defence, Linkoeping (Sweden).

DIALOG WITH A COMPUTER FOR TEXT EDITING AND DATA BASE HANDLING [DIALOG MED EN DATOR FOER TEXTREDIGERING OCH DATABASHANTERING]

Per Thernquist Feb. 1979 84 p In SWEDISH
(FOA-C-20291-X7/H9) Avail: NTIS HC A05/MF A01

Material taken from a course in basic computer techniques is presented with reference to IBM 370 and DEC 10 systems. Use of an interactive terminal is discussed with examples of a text editing system called SOS and a data base management system 1022, written for the DEC 10. Practical exercises are given. Author (ESA)

N80-17739# Centre Technique des Industries Mecaniques, Senlis (France).

ON THE SOLVING OF INTEGRAL EQUATIONS ON A HYBRID COMPUTER Final Report [RESOLUTIONS EQUATIONS INTEGRALES CALCULATEUR HYBRIDE]

Lenclos Feb. 1979 68 p In FRENCH
(CETIM-11-L-05-0) Avail: NTIS HC A04/MF A01

The solving of classical field problems by integral equations using a hybrid computer is examined. The test problem involved describing torsion for a cylindrical bar. After considering the solution of this problem by a Laplace equation, its formation as an integral equation for the contour of the cross section of the bar is presented. The transformations, carried out to condition the data for input on a hybrid computer, are discussed. The organization of the programs for solving the problem are presented and results are shown in print out form. Author (ESA)

N80-17740# Marconi Co. Ltd., Chelmsford (England).

PERFORMANCE ANALYSIS OF VITERBI DECODING OF CONVOLUTIONAL CODED DATA TRANSMITTED OVER A NONLINEAR CHANNEL USING MODSIM

J. K. Potts, S. Shepherd, and C. R. Telfer Dec. 1977 16 p refs 3 Vol.
(Contract ESTEC-2327/74-HP)
(ESA-CR(P)-881-Vol-3) Avail: NTIS HC A02/MF A01

The calculating method described is validated by: a comparison of calculated error probabilities with decoder simulations, and in the case of uncorrelated data, with published results; and a comparison of calculated and extrapolated path preference probabilities with results obtained by the method of statistics of extreme values. The path enumeration importance sampling process which provides an upper bound to the error probability is described. Author (ESA)

N80-17741# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

EVALUATION OF A SIMULATION FRAME PROGRAM FOR THE EAI PACER 600

Hans-Heinz Lange Dec. 1978 31 p refs
(DLR-Mitt-79-01) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, West Ger. DM 7.70

An example of a simulation program is presented. The computer used was a hybrid system with one analog console and two digital processors (EAI Pacer 600 type). The operating features are described and discussed in relation to the options included. Author (ESA)

N80-17742# Loughborough Univ. of Technology (England). Dept. of Mathematics.

THE IMPLEMENTATION OF SOME ANALYTICAL TECHNIQUES ON A COMPUTER

G. A. Evans and J. Hyslop Sep. 1978 16 p refs
(Maths-Res-129) Avail: NTIS HC A02/MF A01

Computing techniques and their associated programs are briefly discussed. Two areas of application are cited: the programming of arithmetic and logical expressions so as to code scientific formulas and numerical methods; and the direct manipulation of algebraic expressions by machines. A hybrid method making use of these two extremes is then presented and its use is demonstrated by examples which form a study of the numerical integration of highly oscillatory integrands. Series reversion involving Bessel functions and the use of Leibnitz theorem are included. The recognition of suitable simple recursions as the main tool in setting up algorithms of this sort is emphasized. Results show a savings in computation time over other analytical techniques. Author (ESA)

N80-17743# Montpellier Univ. (France). Dept. Physique Mathematique.

A PACKAGE OF ROUTINES FOR LINEAR INVERSE PROBLEMS. VOLUME 1: REFINED DATA COMPUTATION

Michel Cuer and Roger Bayer Jan. 1979 30 p refs 4 Vol.
(PM/79/2) Avail: NTIS HC A03/MF A01

A package of FORTRAN routines based on linear programming technique is described. For demonstration purposes the inverse gravity problem, posed by the analysis of data from the measurement of the Earth's gravitational field to obtain information on subsurface mass distribution, is treated. Following a theoretical review of the algebra used in these analyses, the routines for transforming the data into a 'refined form' and subroutines which perform elementary analytic operations are presented. The results from the processing of a three-dimensional artificial case drawn from gravimetric data are shown. Author (ESA)

N80-17744# Montpellier Univ. (France). Dept. Physique Mathematique.

A PACKAGE OF ROUTINES FOR LINEAR INVERSE PROBLEMS. VOLUME 2: ELEMENTARY LINEAR PROGRAMMING ALGORITHMS

Michel Cuer and Roger Bayer Jan. 1979 26 p refs 4 Vol.
(PM/79/3) Avail: NTIS HC A03/MF A01

Algorithms for solving two problems in linear algebra are given. A matrix analysis of gravimetric data is used as an example. For the unknown vector X, the problems are (1) compute a basic feasible solution of AX = b where zero CH-76 or = X CH-76 or = Xmax or show that the problem has no solution, and (2) if the problem has solutions and c sup T is an n-components row vector compute a solution of Ax = b where zero CH-76 or = X CH-76 or = Xmax which minimizes the number (c sup T)X. As an approach to these problems the simplex algorithm is used. Results on the identification of gravity anomalies are shown. Author (ESA)

N80-17745# Montpellier Univ. (France). Dept. Physique Mathematique.

A PACKAGE OF ROUTINES FOR LINEAR INVERSE PROBLEMS. VOLUME 3. PARAMETRIC LINEAR PROGRAMMING ALGORITHM

Michel Cuer and Roger Bayer Jan. 1979 30 p refs 4 Vol.
(PM/79/4) Avail: NTIS HC A03/MF A01

Given two vectors, an algorithm which generates functions to draw curves representative of the bounds on the center of mass of a body which creates an anomaly is presented. Independent variables represent the total mass and the first moment of the mass distribution. Results from the application of this subroutine to artificial gravimetric data are shown. Author (ESA)

N80-17746# Montpellier Univ. (France). Dept. Physique Mathematique.

A PACKAGE OF ROUTINES FOR LINEAR INVERSE PROBLEMS. VOLUME 4. FITTING PROCEDURES IN NORM L INFINITY

Michel Cuer and Roger Bayer Jan. 1979 66 p refs 4 Vol.
(PM/79/5) Avail: NTIS HC A04/MF A01

Given a vector and an index set, an optimization algorithm is presented. The numerical solution generated by the first algorithm is used to solve a second vector value problem and the associated algorithm is also described. Adjustments to previously presented algorithms to solve these two problems are analyzed. The results are used in the computation of an artificial model from the feasible solutions generated by the elementary linear programming algorithms and supported by verified boundary conditions. Results on the density contrast of equivalent layers of the artificial model are shown. Author (ESA)

N80-17747# Research Inst. of National Defence, Linkoeping (Sweden).

SIMPLIFIED PLANE MODEL FOR THE DETERMINATION OF POSSIBLE TARGET POSITION MEASURING PRECISION [FOERENKLAND PLAN MODELL FOER BESTAEMNING AV MOEJLIG MAALINMAETNINGSNOGGRANNHET]

Boerge Lindstroem Jul. 1979 15 p refs In SWEDISH
(FOA-C-20316-E3) Avail: NTIS HC A02/MF A01

The model designed to determine the position of the target, including distance and angle calculation is described. Most of the uncertainties are assumed to be related to the acceleration, while other uncertainties are modeled as uncorrelated stochastic processes. A Kalman type filter is used to determine the target position. Due to geometric factors the calculation is only approximate. Author (ESA)

N80-17748# Technische Hochschule, Darmstadt (West Germany). Fachber. Informatik.

REPORTS ON THE USE OF THE PASCAL P-SYSTEM [ARBEITSBERICHTE ZUM PASCAL P-SYSTEM MIT BEITRAEGEN VON]

Burkhard Austermuehl, George Hechler, and Hans-Jurgen Hoffmann Nov. 1977 41 p refs In GERMAN; ENGLISH summary Submitted for publication
(PU1R3/77) Avail: NTIS HC A03/MF A01

Three reports on the development of the PASCAL P-system for computer programming are presented. Implementation on a SIEMENS BS 2000 computer is described. The interpretive design of the stack computer program, the macroassembling of the stack computer codes, and compilation in assembly language are discussed. The possibility of extending PASCAL through two main features of EL1 language is examined. These are the introduction of generic routines and the treatment of data types as values. The extension of PASCAL through the use of an abstract data type is reported. Author (ESA)

N80-17749# Technische Hochschule, Darmstadt (West Germany). Fachber. Informatik.
A REVIEW OF INTERACTIVE SYSTEMS, EMPHASIZING PROGRAMMING PROCEDURES, THEORETICAL CONCEPTS AND IMPLEMENTATION CONSIDERATIONS [ARBEITEN MIT INTERAKTIVEN SYSTEMEN ERLAEUTERT AM VORGANG DES PROGRAMMIERENS. THEORETISCHE KONZEPTE UND GESICHTSPUNKTE DER REALISIERUNG]
Hans-Jurgen Hoffmann and I. Kupka Oct. 1978 52 p refs In GERMAN; ENGLISH summary
(PU1R6/78; IFI-HH-8-53/78) Avail: NTIS HC A04/MF A01

Models of man machine information exchanges which contribute to a deeper understanding of design, implementation, and usage of systems for interactive programming are reviewed. Emphasis is on the automata theory underlying man machine interaction and the problems posed in structuring the dialogue. Results present various schemes for the structuring of arguments as hierarchies of instructions. Author (ESA)

N80-17750# Technische Hochschule, Darmstadt (West Germany). Fachber. Informatik.
AN INTERACTIVE SYSTEM WHICH ALLOWS USER INPUT OF NONFORMALIZED SPECIFIC CATCHWORDS
Gerhard Knorz Dec. 1978 42 p refs In GERMAN; ENGLISH summary
(PU1R7/78) Avail: NTIS HC A03/MF A01

An interactive system which is able to interpret application oriented in a professional terminology of catchwords, covering a suitably restricted miniworld, is described. The main components of the system, which is controlled by a metasystem, are reported and the approach for handling nonformalized input is described. Development of the system and implementation of its most essential parts is described relative to the syntactical problems encountered when defining terms in natural language for the system. Author (ESA)

N80-17751# Technische Hochschule, Darmstadt (West Germany). Fachber. Informatik.
MODEL OF A MULTILEVEL DIALOG [MODELLE MEHRSCHICHTIGER DIALOGE]
Hans-Jurgen Hoffmann Jan. 1979 25 p refs In GERMAN; ENGLISH summary
(PU1R1/79) Avail: NTIS HC A02/MF A01

The concept of 'levels' is introduced in the modeling of man machine dialogs. An interactive system is defined, consisting of addressable units with which a user can communicate at a given time and with which he exchanges messages. Machine responses can be retained, in which case the user may address another unit later retrieving the stored information, or disregarded, in which case the data is erased. Sequences of dialog steps are classified into forms, such as question answer dialog, command dialog, mixed dialog, parallel dialog, and competitive dialog. Structuring principles for retained responses, including hierarchical structuring of stored subprograms, quasi-simultaneous structuring of stored coroutines, and cooperating processes without explicit structuring are examined. Results are given as a level oriented model of these structuring parameters. Author (ESA)

N80-17752# Technische Hochschule, Darmstadt (West Germany). Fachber. Informatik.
METASYSTEM FOR A DIALOG CONTROL SYSTEM WHICH ACCEPTS INPUT FROM THE USER OF NONFORMALIZED SPECIFIC CATCHWORDS [METASYSTEM FUER EIN SYSTEM ZUR DIALOGFUEHRUNG, DAS ANWENDUNGSBEZOGENE EINGABEN IN EINER STICHWORTARTIGEN FACHSPRACHE AKZEPTIERT]
Gerhard Knorz Jan. 1979 22 p refs In GERMAN; ENGLISH summary
(PU1R3/79) Avail: NTIS HC A02/MF A01

The concept of a man machine interactive system is discussed which allows the use of nonformalized professional terminology in a dialog with the user. The architecture consists of a dialog control system governing the dialog phase of address and a metasystem which handles the concept definitions phase. The dialog control system is discussed only in so far as is necessary to understand the operation of the metasystem. The dialog structure is specified through the metasystem in some descriptive sublanguage the processing of which is explained. The language level in which dialog specifications are given is demonstrated by examples from range profile analysis and descriptive statistics. Author (ESA)

62 COMPUTER SYSTEMS

Includes computer networks.

N80-17753# Naval Postgraduate School, Monterey, Calif.
DISTRIBUTED SHORTEST PATH ALGORITHMS FOR COMPUTER NETWORKS
Jin Y. Yen Aug. 1979 38 p refs
(RR0000101)
(AD-A075415; NPS55-79-017) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper presents two distributed algorithms for finding shortest paths from a source node to all other nodes in an N-node network. These algorithms are executed at individual nodes using only local information. Algorithm 1 works in networks where there are no topological changes such as link failures, link recoveries or changes of link lengths. Algorithm 2 is a modification of Algorithm 1 for networks where there are topological changes. Algorithm 1 determines the optimal shortest paths in at most N3/4 steps, which is only one-half of the computational upper bounds of Abram and Rhodes; and Segall, Merlin and Gallager's algorithms. After the last topological change, Algorithm 2 determines the optimal shortest paths in the same number of steps as Algorithm 1. There are many situations where the present algorithms will work up to N/2 times faster than the algorithms proposed by these authors. GRA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N80-17754 Ohio State Univ., Columbus.
REAL-TIME MULTIPROCESSOR CONTROL OF A HEXAPOD VEHICLE Ph.D. Thesis
Ching-Shu Chao 1979 188 p
Avail: Univ. Microfilms Order No. 8001705

A real time multiprocessor control system which includes an effective servo control scheme as well as a limb coordination algorithm to achieve interactive operation of a hexapod vehicle over level ground under human operator control is developed. The entire control system is separated into two parts, motion planning and motion execution, which run concurrently in a PDP-11/03 and a PDP-11/45 computer. The motion planning block interprets the operator's commands, updates body state variables, implements a wave gait, and computes foot trajectories. The motion execution block provides a servo system which includes two feedback loops: the inner joint-rate servo loop is in leg joint coordinates, and the outer foot-position servo loop is in rectangular body coordinates. Alternative real time software techniques are applied in order to reduce system response time as far as possible utilizing available hardware facilities. Dissert. Abstr.

N80-17755# Massachusetts Univ., Amherst. Dept. of Computer and Information Science.
STUDIES IN IMAGE SEGMENTATION ALGORITHMS BASED ON HISTOGRAM CLUSTERING AND RELAXATION Ph.D. Thesis
P. A. Nagin Sep. 1979 183 p refs
(Contract N00014-75-C-0459)
(AD-A076576; COINS-TR-79-15) Avail: NTIS HC A09/MF A01 CSCL 09/2

The research in this thesis has focussed upon the algorithms and structures that are sufficient to generate an accurate description of the information contained in a relatively complex class of digitized images. This aspect of machine vision is often referred to as 'low-level' vision or segmentation, and usually includes those processes which function close to the sensory data. The bulk of this thesis devotes itself to the exploration of some of the problems typically encountered in segmentation. In addition, a new and robust algorithm is presented that avoids most of these problems. The analysis is carried out through the use of a series of computer-generated tests images with known characteristics. Segmentation algorithms of varying degrees of complexity are applied to each image and their performance is carefully evaluated. It will be shown that even the most sophisticated algorithms that are currently in use often perform poorly when confronted with certain apparently simple images. In particular, it is shown that techniques which rely on histogram clustering often generate gross segmentation errors due to overlap in the distributions of the individual objects in a scene. Moreover, the relaxation processes used to correct these errors are themselves prone to errors, but of a different kind. Both techniques, clustering and relaxation, fail because they are based on information which is too global to be effective in complex scenes. GRA

N80-17756# Maryland Univ., College Park. Computer Science Center.
SOME NEW IMAGE SMOOTHING TECHNIQUES
Ann Scher, Flavio R. D. Velasco, and Azriel Rosenfeld Mar. 1979 30 p refs
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A076351; CSC-TR-733) Avail: NTIS HC A03/MF A01 CSCL 09/4

This report documents a collection of new techniques for image smoothing, and gives examples of their performance. The techniques involve averaging over half-neighborhoods, weighted averaging, and averaging based on local property probabilities. GRA

N80-17757# Stanford Univ., Calif. Dept. of Operations Research.
SIMULATION METHODS FOR RESPONSE TIMES IN NETWORKS OF QUEUES
Donald L. Iglehart and Gerald S. Shedler Aug. 1979 24 p refs
(Contract N00014-76-C-0578; Grant NSF MCS-79-09139)
(AD-A075173; SU-TR-49) Avail: NTIS HC A02/MF A01 CSCL 12/1

Theoretically sound and computationally efficient estimation methods for 'passage times' in certain closed networks of queues is described. Informally, a passage time is the time for a job to traverse a portion of the network. Such quantities are important in computer and communication system models where they represent job response times, and in this context, quantities other than mean values are of interest. From a single simulation run, the methods described here provide both point estimates and confidence intervals for general characteristics of response times. GRA

N80-17758# Stanford Univ., Calif. Dept. of Operations Research.
REGENERATIVE SIMULATION OF RESPONSE TIMES IN NETWORKS OF QUEUES: STATISTICAL EFFICIENCY
Donald L. Iglehart and Gerald S. Shedler Sep. 1979 47 p refs
(Contract N00014-76-C-0578; Grant NSF MCS-75-23607)
(AD-A075174; TR-51) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this report the calculation of variance constants entering into central limit theorems used to obtain confidence intervals from passage time simulations is considered. Using results of Hordijk, Iglehart, and Schassberger for the calculation of moments in discrete time and continuous time Markov chains, we calculate variance constants pertinent to mean passage times. This is done first for the 'marked job method' for passsage time simulation which is based on the tracking of a distinguished job, and then for the 'decomposition method' in which observed passage times for all of the jobs enter into the construction of point and interval estimates. The results of this paper provide a means of comparing the statistical efficiency of the two estimation methods. GRA

N80-17759# Illinois Univ. at Urbana-Champaign. Decision and Control Lab.
TWO-TIME SCALE DISCRETE SYSTEMS M.S. Thesis
R. G. Phillips Feb. 1979 116 p refs
(Contracts DAAB07-72-C-0259; DAAG29-78-C-0016; Contract EX-76-C-01-2088)
(AD-A077146; DC-22; UILU-ENG-78-2232) Avail: NTIS HC A06/MF A01 CSCL 12/1

The approach taken in this thesis is to decouple a two-time-scale discrete system into slow and fast subsystems. The phenomena of a boundary layer, possible order reduction, and independent slow and fast subsystems are analyzed. The analogy with continuous singularly perturbed systems is discussed throughout the text. A real time algorithm is presented which enables separate design and update of slow and fast control laws. GRA

N80-17760# Centre Technique des Industries Mecaniques, Senlis (France).
ON THE IMPROVEMENT OF AUTOMATIC CONTROL BY USING DATA PROCESSING. THE INTEGRATION OF ULTRASONIC INSPECTION WITH THE MANUFACTURING OF FINE TOLERANCE PARTS [AMELIORATION DU CONTROLE AUTOMATIQUE PAR L'EMPLOI D'UN TRAITEMENT INFORMATIQUE. CASDU CONTROLE PAR ULTRASONS INTEGRE A LA FABRICATION DES PIECES DE VALEUR]
J. Rivenez 5 Dec. 1978 23 p In FRENCH
(CETIM-15-H-19-0) Avail: NTIS HC A02/MF A01

Ultrasonic inspection as used in industry is reviewed. The data processing of ultrasonic echos is considered. The combination of ultrasonic inspection with data reduction and processing for verifying the tolerances on large forged parts is analyzed. Results are used to show the feasibility of a similar integration of ultrasonics and EDP for inspecting fine tolerances on precision parts. Author (ESA)

N80-17761# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
A PROPERTY OF AN AUTONOMOUS MINIMAX OPTIMAL CONTROL PROBLEM
Kjell Holmaaker 1979 8 p refs
(CTH-Math-1979-21) Avail: NTIS HC A02/MF A01

A control system, scalar product of X = f(x,u), with cost functional ess sup T sub zero < or = t < or = T sub 1, G (x(-t), u(t)) is considered. For an optimal pair (X bar (scalar product), u bar (scalar product)) there is a maximum principle of the form eta (t) f(x bar (t), u bar (t)) = Max, where u is an element of Omega (t), eta (t)f(x bar (t), u). By means of this fact it is shown that eta (t)f(x bar (t), u bar (t)) is equal to a constant almost everywhere. Author (ESA)

N80-17762# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Computer Sciences.
ON FINITE ELEMENT METHODS FOR OPTIMAL CONTROL PROBLEMS, PART 1
Claes Johnson 1979 59 p refs 2 Vol.
(CTH-79.03-R) Avail: NTIS HC A04/MF A01

The use of finite element methods in the solution of optimal control problems on Hilbert spaces with linear and continuous dynamics as well as closed and convex state control constraints is discussed. Discretized versions of the problem are considered in order to find approximate solutions. The problem of estimating the error between the exact solution and the approximate solution is also considered. Various algorithms for finding a numerical solution are shown together with results of some numerical experiments. Author (ESA)

N80-17763# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Computer Sciences.
ON FINITE ELEMENT METHODS FOR OPTIMAL CONTROL PROBLEM. PART 2: ILL POSED PROBLEMS
Claes Johnson 1979 23 p refs 2 Vol.
(CTH-79.04-R) Avail: NTIS HC A02/MF A01

The use of finite element methods in the solution of optimal control problems on Hilbert spaces with linear and continuous dynamics as well as closed and convex state-control constraints is discussed. Problems with nonlinear state equations or constraints on the state are considered along with problems in which the solution, u, does not depend continuously on the right hand side of Au = z sub d. Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-17764 Notre Dame Univ., Ind.
MULTIVARIABLE FEEDBACK LOOP CLOSURES: AN APPROACH BY EXTERIOR ALGEBRA Ph.D. Thesis
V. Seshadri 1980 133 p
Avail: Univ. Microfilms Order No. 8002624

A structure called the exterior algebra, which is especially well-suited for addressing problems that involve determinants and inverses is described wherein the notions of quotients and tensor products are introduced from algebraic viewpoint and then these ideas are used to construct the desired exterior algebra. The exterior algebraic structure is viewed in action by using it to formulate the problem of feedback loop closures; the loops being closed one by one. It is shown that this problem of feedback loop closures is intimately related to certain exterior algebraic structures called induced exterior morphisms; this provides insight into the nature of zeros of multivariable systems. Individual closed-loop zeros, of a system with output feedback, are considered. A method for pole- and zero-placement under rank-one feedback is obtained, and it is illustrated with both handworked and machine-worked examples; the computer program used to solve the latter is also listed. Dissert. Abstr.

N80-17765*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APPLYING INTEGRALS OF MOTION TO THE NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS
Donald J. Jezewski Dec. 1979 28 p refs
(NASA-TM-80945; JSC-16302; Rept-79-FM-47) Avail: NTIS HC A03/MF A01 CSCL 12A

A method is developed for using the integrals of systems of nonlinear, ordinary differential equations in a numerical integration process to control the local errors in these integrals and reduce the global errors of the solution. The method is general and can be applied to either scaler or vector integrals. A number of example problems, with accompanying numerical results, are used to verify the analysis and support the conjecture of global error reduction. K.L.

N80-17766*# National Aeronautics and Space Administration, Washington, D. C.
COMMENTS ON NUMERICAL SOLUTION OF BOUNDARY VALUE PROBLEMS OF THE LAPLACE EQUATION AND CALCULATION OF EIGENVALUES BY THE GRID METHOD
L. A. Lyusternik Jan. 1980 25 p Transl. into ENGLISH from Tr. Mat. Inst. imeni V. A. Steklov (USSR), v. 20, 1947 p 49-64 Transl. by Scientific Translation Services, Santa Barbara, Calif. (Contract NASw-3198)
(NASA-TM-75770) Avail: NTIS HC A02/MF A01 CSCL 12A

The mathematics involved in numerically solving for the plane boundary value of the Laplace equation by the grid method is developed. The approximate solution of a boundary value problem for the domain of the Laplace equation by the grid method consists of finding u at the grid corner which satisfies the equation at the internal corners (u=Du) and certain boundary value conditions at the boundary corners. A.R.H.

N80-17767# California Univ., Berkeley. Operations Research Center.
SOLUTIONS OF SPHERICAL INEQUALITIES
David Gale Sep. 1979 10 p refs
(Contract N00014-76-C-0314; Grant NSF SOC-78-05196)
(AD-A076597; ORC-79-10) Avail: NTIS HC A02/MF A01 CSCL 12/1

It is shown that the problem of finding a point in the intersection of a finite number of balls in n-space is equivalent to solving a very simple (one constraint) quadratic program. GRA

N80-17768# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
A NUMERICAL COMPARISON BETWEEN TWO UNCONSTRAINED VARIATIONAL FORMULATIONS
J. J. Wu and T. E. Simkins Sep. 1979 36 p refs
(AD-A076176; AD-E440050; ARLCB-TR-79024) Avail: NTIS HC A03/MF A01 CSCL 12/1

In an effort to relieve the often cumbersome burden of meeting the requirements on the end conditions and to unify the solution formulation for boundary- and initial-value problems, unconstrained variational statements have been introduced in conjunction with some approximate methods. In the case of a boundary value problem, it is shown in this paper that two different variational statements can be established: one is arrived at by the use of the LaGrange multipliers, the other by energy considerations. The numerical convergence of the solutions associated with finite element schemes using one of these two different variational statements is compared with that of the other. In the case of an initial value problem, both formulations can again be established when the adjoint field variable and the adjoint variational statement are introduced. The numerical data presented here indicate that while both methods generate excellent convergent results for the boundary value problem, the method of stiff springs yields results which show much better convergence for the initial value problem than those achieved by LaGrange multipliers. GRA

N80-17769# Illinois Univ. at Urbana-Champaign. Decision and Control Lab.
ZEROS OF MULTIVARIABLE SYSTEMS: DEFINITIONS AND ALGORITHMS M.S. Thesis
D. K. Lindner May 1979 192 p refs
(Contracts DAAG29-78-C-0016; EX-76-C-01-2088; Grants NSF ENG-74-20091; AF-AFOSR-3633-78)
(AD-A077147; DC-23; UILU-eng-78-2234) Avail: NTIS HC A09/MF A01 CSCL 12/1

A number of definitions of zeros of linear time-invariant multivariable systems have appeared recently. This work surveys selected literature on these zeros. Two questions are addressed here. First, how are zeros defined and how are these definitions interrelated. Second, how can they be calculated. The definitions of zeros are considered for three system representations: (1) the transfer function matrix, (2) the state space representation in the frequency domain, and (3) the state space representation in the time domain. The definitions of zeros for transfer function matrices are shown to be (mostly) equivalent. However, several different sets of zeros are defined for state space representations. The interrelationships between all of these definitions is discussed in detail. It turns out that the calculation of zeros directly from the definitions is not always tractable. The properties of zeros, however, provide several algorithms for calculating zeros. Finally, a new algorithm for the calculation of invariant zeros is introduced. It is based on the geometrical properties of linear time invariant systems. This algorithm is applicable to the most general class of systems (A,B,C,D). GRA

N80-17770# North Carolina State Univ. at Raleigh. Dept. of Mathematics.
RESEARCH ON NONLINEAR DIFFERENTIAL EQUATIONS Final Report, 24 Sep. 1976 - 23 Sep. 1979
Robert H. Jr. Martin 12 Oct. 1979 12 p refs
(Grant DAAG29-76-G-0332)
(AD-A076500; ARO-14020.2-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

The research deals with the application of abstract techniques in the study of the behavior and (asymptotic) stability of solutions to differential equations of reaction-diffusion type. These equations include models in a cellular control process with positive feed-back and a model in gas-liquid reactions. Most of the results are based on techniques that involve the determination of invariant sets for solutions and the preservation of inequalities between solutions. GRA

N80-17771# California Univ., Berkeley. Electronics Research Lab.

SOLVER: AN ANALYTIC FUNCTION ROOT SOLVING AND PLOTTING PACKAGE

H. Stephen Au-Yeung and Alex Friedman 31 Aug. 1979 72 p
(Contracts N00014-77-C-0578; DE-AS03-76SF-00034)
(AD-A075803; UCB/ERL-M79/55) Avail: NTIS HC A04/MF A01 CSCL 09/2

SOLVER is a root solver that provides automatic compilation, loading, and execution. It uses a simple version of Muller's method. SOLVER is intended for the occasional user who needs roots but balks at learning to use sophisticated but complicated solvers, which usually also require considerable additional programming. The user need only supply the function to be set to zero and the number of solutions desired. SOLVER is available on the CRAY-1 computer. GRA

N80-17772# Maryland Univ., College Park. Computer Science Center.

REGION REPRESENTATION BOUNDARY CODES FROM QUADTREES

Charles R. Dyer, Azriel Rosenfeld, and Hanan Samet Feb. 1979 29 p refs
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A076352; OSC-TR-732) Avail: NTIS HC A03/MF A01 CSCL 09/4

There has been recent interest in the use of quadtrees to represent regions in an image. It thus becomes desirable to develop efficient methods of conversion between quadtrees and other types of region representations. This paper presents an algorithm for converting from quadtrees to a simple class of boundary codes. GRA

N80-17773# Wisconsin Univ. - Madison. Mathematics Research Center.

GLOBAL STABILITY OF STATIONARY SOLUTIONS OF REACTION-DIFFUSION SYSTEM

R. A. Gardner Sep. 1979 16 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-09525)
(AD-A077138; MRC-TSR-1993) Avail: NTIS HC A02/MF A01 CSCL 12/1

A condition is given which implies that the trivial solution, U is identically equal to O, of a class of reaction-diffusion systems with homogenous Dirichlet boundary conditions, is a global attractor for all non-negative solutions. In certain cases, this condition, which relates the diffusion matrix and the domain to a parameter which depends on the nonlinear term, significantly improves similar conditions which can be obtained from energy estimates. Applications are given to equations arising in mathematical ecology. GRA

N80-17774# Stanford Univ., Calif. Dept. of Computer Science.

PERFORMANCE OF UPDATE ALGORITHMS FOR REPLICATED DATA IN A DISTRIBUTED DATABASE Ph.D. Thesis

Hector Garcia-Molina Jun. 1979 164 p refs
(Contract MDA903-77-C-0322)
(AD-A075268; SU-STAN-CS-79-744; SU-STAN-CSL-TR-172) Avail: NTIS HC A08/MF A01 CSCL 12/1

In this thesis we study the performance of update algorithms for replicated data in a distributed database. In doing so, we also investigate several other related issues. We start by presenting a simple model of a distributed database which is suitable for studying updates and concurrency control. We also develop a performance model and a set of parameters which represent the most important performance features of a distributed database. The distributed database models are used to study the performance of update algorithms for replicated data. This is done in two steps. First the algorithms are analyzed in the case of completely replicated databases in a no failure, update only environment. Then, the restrictions that we made are eliminated one at a time, and the impact on the system performance of doing this is evaluated. For the first step, we develop a new technique for analyzing the performance of update algorithms. This iterative technique is based on queueing theory. Several well known update algorithms are analyzed using this technique. The performance results are verified through detailed simulations of the algorithms. The results show that centralized control algorithms nearly always perform better than the more popular distributed control algorithm. GRA

N80-17775# Lockheed Missiles and Space Co., Palo Alto, Calif. Palo Alto Research Lab.

PARTITIONED TRANSIENT ANALYSIS PROCEDURES FOR COUPLED-FIELD PROBLEMS: ACCURACY ANALYSIS

K. C. Park and C. A. Felippa Jul. 1979 34 p refs
(Contract N00014-74-C-0355)
(AD-A075685; LMSC-D678072) Avail: NTIS HC A03/MF A01 CSCL 12/1

Partitioned solution procedures for direct time integration of second-order coupled-field systems are studied from the standpoint of accuracy. Such procedures are derived by three formulation steps: implicit integration of coupled governing equations, algebraic partitioning, and extrapolation to advance the solution. It is shown that the combined effect of partition, extrapolation and computational paths, dictates the choice of stable extrapolators and the preservation of rigid-body motions. Stable extrapolators for various computational paths are derived and implementation-extrapolator combinations which preserve rigid-body motions are identified. A spectral analysis shows that the partition itself, when stable, affects primarily frequency distortion. Finally, the advantages and shortcomings of five partitioned procedures are discussed as a guide to practical applications. GRA

N80-17776# Wisconsin Univ. - Madison. Mathematics Research Center.

NONLINEAR SCHROEDINGER EVOLUTION EQUATIONS

H. Brezis and T. Gallouet Sep. 1979 12 p refs
(Contract DAAG29-75-C-0024)
(AD-A077137; MRC-TSR-1992) Avail: NTIS HC A02/MF A01 CSCL 12/1

The nonlinear Schroedinger equation occurs in the study of some problems in nonlinear optics (propagation of laser beams through the atmosphere or in a plasma). The main novelty of the present result is that it applies to the propagation of beams in channels (instead of the whole space). The proof relies on a new Sobolev-Orlicz embedding inequality which could be useful in other situations. GRA

N80-17777# Wisconsin Univ. - Madison. Mathematics Research Center.

NUMERICAL STABILITY IN AN INVERSE SCATTERING PROBLEM

W. W. Symes Aug. 1979 49 p
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-09525)
(AD-A077135; MRC-TSR-1990) Avail: NTIS HC A03/MF A01 CSCL 12/1

The main result of this paper is a stability theorem for a certain class of difference algorithms designed to give approximate solutions of a model inverse scattering problem in one dimension. This stability result guarantees the convergence of the approximate solutions to the exact solution of the problem as the grid of the difference scheme is refined. The results of numerical experiments are presented based on one of these schemes, in which second-order convergence is observed. Furthermore, the cost (that is, the dependence on N of the number of arithmetic operations required to compute the solution at N grid points) of the algorithms discussed below is essentially optimal. GRA

N80-17778# Wisconsin Univ. - Madison. Mathematics Research Center.

LOCAL FIXED POINT INDEX THEORY FOR NONSIMPLY CONNECTED MANIFOLDS

Edward Fadell and Sufian Husseini Aug. 1979 43 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-01451)
(AD-A077133; MRC-TSR-1988) Avail: NTIS HC A03/MF A01 CSCL 12/1

Given a compactly fixed map f:U yields M, where U is an open subset of a manifold M, it is a classical result that one can assign an integer-valued index I(f,U) to this situation with the property that I(f,U) is not equal to O implies f (and any compactly fixed perturbation of f) has fixed points in U, i.e., solutions to the equations f(x) = x. However, it can still happen that i(f,U) = 0 and f has essential fixed points in U. The objective of this paper is to provide a finer invariant o(f,U), called the local obstruction index, which has the property that o(f,U) is not = to 0 if, and only if, every compactly fixed perturbation of f has fixed points in U. The main objective is to assign to this data a new index, o(f,U), which is not necessarily an integer, which removes this fundamental defect so that now the equation has essential solutions in U. A general formula for computing the value of o(f,U) is also given. GRA

N80-17779# Wisconsin Univ. - Madison. Mathematics Research Center.

A PHASE PLANE DISCUSSION OF CONVERGENCE TO TRAVELING FRONTS FOR NONLINEAR DIFFUSION

P. C. Fife and J. B. McLeod Jul. 1979 49 p refs
(Contract DAAG29-75-C-0024)
(AD-A077131; MRC-TSR-1986) Avail: NTIS
HC A03/MF A01 CSCL 12/1

The asymptotic behavior as it approaches infinity was studied of solutions u(x,t) of the equation u sub t-u sub xx -f(u) = 0, x an element from minus infinity to infinity, in the case f(0) = f(1) = 0, with f(u) nonpositive for u(< 0) sufficiently close to 1. This guarantees the uniqueness (but not the existence) of a traveling front solution u = U(x-ct), U(minus infinity) = 0, U(infinity) = 1, and it is shown in essence that solutions with monotonic initial data converge to a translate of this traveling front if it exists, and to a stacked combination of traveling fronts if it does not. The approach is to use the monotonicity to take u and t as independent variables and p = u sub x as the dependent variable, and apply ideas of sub and supersolutions to the diffusion equation for p. R.C.T.

N80-17780# Wisconsin Univ. - Madison. Mathematics Research Center.

A SIMPLE RELIABLE NUMERICAL ALGORITHM FOR FOLLOWING HOMOTOPY PATHS

Tien-Yien Li and James A. Yorke Jul. 1979 22 p refs
(Contract DAAG29-75-C-0024; Grants NSF MCS-76-24432; NSF MCS-78-02420; NSF MCS-78-09525)
(AD-A077129; MRC-TSR-1984) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The purpose of this paper is to develop simple algorithms and flow charts for the homotopy continuation methods so that scientists may easily program reliable curve followers. The emphasis is on simplicity and reliability at the expense of the speed. GRA

N80-17781# Wisconsin Univ. - Madison. Mathematics Research Center.

ON A PATH FOLLOWING METHOD FOR SYSTEMS OF EQUATIONS

C. B. Garcia and T. Y. Li Jul. 1979 17 p refs
(Contract DAAG29-75-C-0024; Grant DAAG29-78-G-0160)
(AD-A077128; MRC-TSR-1983) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The problem of finding one or all solutions to systems of equations, equilibrium, fixed points, or to dynamical systems is considered. In the last few years, a new method has emerged for solving this problem. The idea is to start at a given solution of a simpler problem and to follow a path of solutions as the path parameter (and hence, the problem) is gradually changed. This path is proved to exist via topological approaches and is shown to lead to the 'right' place. In this paper, a general predictor-corrector method is described for following the curve. It is a globalization of the classical Davidenko approach. It is shown that the method can follow the path to any desired degree of accuracy and is convergent. GRA

N80-17782# Wisconsin Univ. - Madison. Mathematics Research Center.

EFFICIENT MULTISTEP PROCEDURES FOR NONLINEAR PARABOLIC PROBLEMS WITH NONLINEAR NEUMANN BOUNDARY CONDITIONS

R. E. Ewing Jul. 1979 24 p refs
(Contract DAAG29-75-C-0024; Grant DAAG29-78-G-0161; Grant NSF MCS-78-09525)
(AD-A077127; MRC-TSR-1982) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Efficient multistep procedures for time stepping Galerkin methods for nonlinear parabolic partial differential equations with nonlinear Neumann boundary conditions are presented and analyzed. The procedures involve using a preconditioned iterative method for approximately solving the different linear equations arising at each time step in a discrete time Galerkin method. Optimal order convergence rates are obtained for the iterative methods. Work estimates of almost optimal order are obtained. R.C.T.

N80-17783# Wisconsin Univ. - Madison. Mathematics Research Center.

ON ABSTRACT VOLTERRA EQUATIONS WITH KERNELS HAVING A POSITIVE RESOLVENT

P. H. Clement Jul. 1979 13 p refs
(Contract DAAG29-75-C-0024)
(AD-A077124; MRC-TSR-1979) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The nonlinear abstract Volterra equation of convolution type is considered. Boundedness and asymptotic properties of the solutions are established under the assumption that the kernel satisfies certain natural positivity conditions. An important property of linear and nonlinear diffusion equations is that the solutions of such equations obey a 'maximum principle'. In particular, if the initial data and the forcing terms are nonnegative, then the solution is nonnegative. The Volterra equation (V) is an abstraction of a mathematical model for nonlinear heat flow in a material with 'memory'. The kernel b in (V) can be expressed in terms of the physically meaningful heat flux and internal energy relaxation functions. In this paper equation (V) for a class of kernels b is considered which insure the positivity of the solution operator. GRA

N80-17784# Wisconsin Univ. - Madison. Mathematics Research Center.

BOUNDS FOR EIGENVALUES OF HERMITIAN TRENCH MATRICES Technical Summary Report, 1977 - Jul. 1979

T. N. E. Greville Jul. 1979 21 p refs
(Contract DAAG29-75-C-0024)
(AD-A077122; MRC-TSR-1977) Avail: NTIS
HC A02/MF A01 CSCL 12/1

A necessary condition for a strictly banded matrix to have to have a Toeplitz inverse is that it have a certain special structure fully characterized by two polynomials, A(x) of degree r and B(x) of degree s. This special structure is a Toeplitz matrix. A Trench matrix is nonsingular if and only if A(x) and B(x) have no common zero, and a strictly banded matrix has a Toeplitz inverse if and only if it is a nonsingular Trench matrix. Bounds are established for eigenvalues of Hermitian Trench matrices that depend on only the polynomials A(x) and B(x) and not on the order of the matrix. GRA

N80-17785# Wisconsin Univ. - Madison. Mathematics Research Center.

ON THE EXISTENCE OF HERMITE-BIRKHOFF QUADRATURE FORMULAS OF GAUSSIAN TYPE Technical Summary Report, 1978 - Jul. 1979

Nira Dyn Jul. 1979 16 p refs
(Contract DAAG29-75-C-0024)
(AD-A077123; MRC-TSR-1978) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Existence of Gaussian quadrature type formulas related to Hermite-Birkhoff interpolation is proved for a class of incidence matrices satisfying the conditions of the Atkinson-Sharma Theorem. For the subclass of Hermite matrices this analysis furnishes yet another proof of the existence of Gaussian quadrature formulas with multiple nodes. GRA

N80-17786# Wisconsin Univ. - Madison. Mathematics Research Center.

A PRIORI ESTIMATES AND EXISTENCE RESULTS FOR SOME SEMILINEAR ELLIPTIC PROBLEMS

P. L. Lions Jul. 1979 10 p refs
(Contract DAAG29-75-C-0024)
(AD-A077106; MRC-TSR-1975) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Problems arising in, for example, physics, biology and chemical reactors lead to boundary value problems for semilinear elliptic equations. The question of identifying for which nonlinearities these semilinear problems have solutions is by no means settled. Roughly speaking, nonlinearities which grow too rapidly yield unsolvable problems while under other conditions on the growth, existence can be proved. Some conditions are improved which were previously known to guarantee the existence of positive solutions of such problems. GRA

N80-17787# Wisconsin Univ. - Madison. Mathematics Research Center.

THE GROWTH OF POWERS OF A NON-NEGATIVE MATRIX

Shmuel Friedland and Hans Schneider Jun. 1979 28 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-01087)
(AD-A077094; MRC-TSR-1963) Avail: NTIS HC A03/MF A01 CSCL 12/1

Let A be a non-negative nxn matrix. In this paper the growth of the powers. A to the M power, m – 1,2,3,... is studied. These powers occur naturally in an iteration process which is important in applications and numerical techniques. Roughly speaking, the asymptotic behavior of each entry of A to the m power is analyzed. The main result is applied to determine necessary and sufficient conditions for the convergence to the spectral radius of A of certain ratios naturally associated with the iteration presented. GRA

N80-17788# Centre Technique des Industries Mecaniques, Senlis (France).

ALGORITHMS FOR DECOUPLING VIBRATORY MODES Final Report [ALGORITHMES DE DECOUPLAGE MODES VIBRATOIRES]

Garcin Feb. 1979 81 p In FRENCH Prepared in cooperation with Besancon Univ., France
(CETIM-1-1E-24-0) Avail: NTIS HC A05/MF A01

An algorithmic study of the decoupling of vibratory modes on a SAVIEM test rig is presented. Inconclusive results from the study are examined including a lack of accuracy in frequency measurement at the experimental stage, an insufficient number of measurement points, a highly nonlinear response to amplitude variations at the test rig, and the lack of an acceptable data smoothing procedure. Author (ESA)

N80-17789# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.

MEASURABLE SET-VALUED FUNCTIONS

Kjell Holmaaker 1979 51 p refs
(CTH-Math-1979) Avail: NTIS HC A04/MF A01

The theory of measurable set-valued functions is introduced. The considered functions are defined on a measureable subset of R and have values that are nonempty subsets of R sup N. Several possible definitions of measurability and their relationships are examined. After a section on integrals of set-valued functions, some applications to control theory are shown. Author (ESA)

N80-17790# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.

METHODS AND TRADITIONS OF BABYLONIAN MATHEMATICS. PART 2: AN OLD-BABYLONIAN CATALOGUE TEXT WITH EQUATIONS FOR THE SQUARE AND THE CIRCLE

Joeran Friberg 1979 17 p refs
(CTH-Math-1979-14) Avail: NTIS HC A02/MF A01

The text of the Old Babylonian clay tablet BM 80 209 is analyzed. It is shown to be a catalog of linear and quadratic equations, expressed in geometric quantities such as area, diameter, circumference, etc., of circles or squares. Similarities between the present text and two catalog texts from Susa as well as a mathematical compendium from Tell Harmal and Heron's Geometry written two thousand years later are briefly noted. Author (ESA)

N80-17791# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.

INTEGRAL FORMULAS FOR THE (ALPHA ALPHA-BAR) EQUATION AND ZEROS OF BOUNDED HOLOMORPHIC FUNCTIONS IN THE UNIT BALL

Bo Berndtsson 1979 23 p refs
(Contract SWED-NSRC-F-2989-005)
(CTH-Math-1979-16) Avail: NTIS HC A02/MF A01

Solutions of the alpha alpha-bar equation are constructed using integral formulas. The result is applied to give a sufficient condition for a zero set in the unit ball in domain sup 2 or domain sup 3 to be defined by a bounded holomorphic function. For domain sup 2 this condition says that the zero set has finite area. Author (ESA)

N80-17792# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.

PATH DECOMPOSITION AT BACKWARD TIMES IN REGENERATIVE SETS

Olav Kallenberg 1979 32 p refs
(CTH-Math-1979-17) Avail: NTIS HC A03/MF A01

A backward time is a random time which only depends on the future, in the same sense as a stopping time only depends on the past. It is shown that a backward time taking values in a regenerative set M splits M into conditionally independent subsets and that the conditional distributions on the left are given by the Palm distributions with respect to the local time random measure xi of M. The strongest results hold at points where (P sub t) has a continuous version which occurs essentially where the renewal measure E (xi) has a continuous density p. The continuity set of p is described rather precisely in terms of the growth rate and regularity properties of the Levy measure of M. Author (ESA)

N80-17793# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.

ON SUBGRADIENTS OF A CONVEX FUNCTION IN ABSTRACT WIENER SPACE

Christer Borell 1979 9 p refs
(CTH-Math-1979-20) Avail: NTIS HC A02/MF A01

An abstract Wiener space (S, beta) is defined such that S is a real, locally convex Hausdorff vector space and beta a fixed centered Gaussian Radon measure on S. The main result shows that any convex function f's tends to R cup braces + infinity braces being bounded above on a set of positive beta measure, has a beta measurable subgradient at each point in the set ri sub beta braces f < + infinity braces. Author (ESA)

N80-17794# Loughborough Univ. of Technology (England). Dept. of Mathematics.

ON NUMBERS MISSED BY THE DIVISOR FUNCTION d SUB 3(N)

P. Shiu Apr. 1978 9 p refs
(Maths-Res-126) Avail: NTIS HC A02/MF A01

The missing value problem is generalized to d sub 3 (n), the number of ways of writing as a product of three factors. It is shown that the range of d sub 3 (n) is the set R sub 3 of numbers which are products of triangular numbers. The least integer in the set M sub 3 (x) is identified. K.L.

N80-17795# Loughborough Univ. of Technology (England). Dept. of Mathematics.

THE DECOMPOSITION PRINCIPLE AND THE SPECTRUM OF THE DIRAC EQUATIONS

B. J. Harris Apr. 1978 19 p refs
(Maths-Res-127) Avail: NTIS HC A02/MF A01

A decomposition principle for the Dirac equations which gives criteria under which the spectrum of Dirac equations is independent of the behavior of the potential in compact regions is presented. The main result is a decomposition theorem which states, that provided P satisfies certain conditions which restrict its singularities, the essential spectrum of T + P, the self adjoint operator, is independent of the behavior of P on compact regions of Hilbert space. Author (ESA)

N80-17796# Loughborough Univ. of Technology (England). Dept. of Mathematics.

OPTIMIZATION USING RATIONAL FUNCTIONS

C. Storey Nov. 1978 9 p refs Presented at 3rd Symp. Ueber Operations Res., Mannheim, West Ger., 6-8 Sep. 1978
(Maths-Res-131) Avail: NTIS HC A02/MF A01

The use of rational functions as approximations to a general function of a single variable in the context of univariate minimization is discussed. An algorithm for the application of the technique was devised and used on a number of test functions.

Some comparison of this rational function algorithm with other methods is given. In approximation theory it is well known that rational functions have certain advantages over polynomials and it was hoped that they would offset the extra computation required in fitting the rationals. Numerical evidence accrued shows that the use of rational function approximations is valid in optimization. Results for univariate minimization and as a line search technique are good. The use of rational function approximations for optimization of many variable problems, however, still presents a number of problems. Author (ESA)

N80-17797# Loughborough Univ. of Technology (England). Dept. of Mathematics.
ON SQUARE-FULL INTEGERS
P. Shiu Nov. 1978 15 p refs
(Maths-Res-134) Avail: NTIS HC A02/MF A01

A positive integer q is called square-full if p squared divides q whenever p is a prime divisor of q. The nth square-full integer is denoted by q sub N. Each q sub N is written uniquely as (a squared)(b cubed) where b is a square-free integer. Let X > or = 1 and denote by Q(X) the number of integers q sub N < or = X. It is proved that as X tends to infinity, Q(X) = Ax to the 1/2 power + Bx to the 1/3 power + O(X to the 1/6 power), where A = zeta(3/2)/zeta(3) and B = zeta(2/3)/zeta(2). Two gap problems associated with the square-full integers are then considered. Finally, two inequalities are studied and shown to hold relative to the gaps between square-free integers. Author (ESA)

N80-17798# Loughborough Univ. of Technology (England). Dept. of Mathematics.
ON DIRAC FIELDS IN A CURVED SPACE-TIME
J. B. Griffiths Dec. 1978 18 p refs
(Maths-Res-135) Avail: NTIS HC A02/MF A01

It is shown that spin 1/2 particles with non-zero rest mass have certain anomalous properties in a curved space-time. For example, the sign of their energy density may be observer dependent. In addition, the complete energy-momentum tensor may vanish in some space-times. The anomalies associated with neutrino fields in general relativity are also shown to occur with Dirac fields. Such fields may be energy nondefinite and ghost solutions may occur. Thus, spin 1/2 particles tend not to satisfy the energy condition that is required for the singularity theorems in general relativity. For weak gravitational fields the anomalies considered may never occur. However, in a situation of gravitational collapse, Dirac particles do not satify the usual energy conditions. Author (ESA)

N80-17799# Loughborough Univ. of Technology (England). Dept. of Mathematical Sciences.
FURTHER REMARKS ON THE CONTROLLABILITY OF LINEAR CONSTANT DELAY-DIFFERENTIAL SYSTEMS
M. G. Frost (Trent Polytech., Nottingham, Engl.) and C. Storey Feb. 1979 15 p refs
(Maths-Res-136) Avail: NTIS HC A02/MF A01

Function space null controllability is considered for certain delay differential systems. The implications of the input decoupling factors and input decoupling zeros of the corresponding system matrices are examined. Results demonstrate that a transformation of system similarity over the defined function space between the discussed system matrices will preserve the function space null controllability. It does not follow that system matrices which correspond to function space null controllable systems (and have no output decoupling factor) are system similar over the defined function space if they correspond to the same transfer function matrix. Author (ESA)

N80-17800# Loughborough Univ. of Technology (England). Dept. of Mathematical Sciences.
TRANSFORMATIONS OF STRICT SYSTEM EQUIVALENCE BETWEEN POLYNOMIAL SYSTEM MATRICES OVER STATE-SPACE (s, z)
M. G. Frost (Trent Polytech., Nottingham, Engl.) and C. Storey Feb. 1979 17 p refs
(Maths-Res-137) Avail: NTIS HC A02/MF A01

Conditions are established under which polynomial system matrices over state space s, z are strictly system equivalent over state space s, z . The conditions under which polynomial system matrices are strictly system equivalent over state space s, z rather than state-space (z)s are discussed. Conditions under which the zeros of the two matrices are presented by a transformation of strict system equivalence of the state-space system matrices exists if and only if they correspond to the same transfer function matrix. Author (ESA)

N80-17801# Technische Hochschule, Darmstadt (West Germany). Fachber. Informatik.
TEMPLATE OVERLAPS IN TREE MANIPULATION SYSTEMS
Hans H. Kron Jun. 1978 32 p refs Presented at the Workshop WG 78 Graphentheoretische Konzepte in der Informatik, Feuerstgin, West Ger., 15-17 Jun. 1978
(PU1R1/78) Avail: NTIS HC A03/MF A01

The use of tree templates as the basis for a variety of parametric pattern manipulating systems is analyzed. Parameters are matched against a tree to select a node of application, relevant subtrees, and a manipulation rule. The possibility of ambiguity arising since a given set of templates might match the tree at a given node is discussed and a rule determining the most specific of the templates is given. The concepts of linear templates tree of multiple occurrences of parameters and of template meeting are developed. The representation of linear template overlaps as meet semilattices is examined. Author (ESA)

N80-17257 Wright State Univ., Dayton, Ohio.
LAGUERRE FUNCTION REPRESENTATIONS OF TRANSIENTS
G. R. Spalding *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 137-141 refs
(For primary document see N80-17247 08-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-17802 California Univ., Berkeley.
EXPLORATORY LONGITUDINAL FACTOR ANALYSIS Ph.D. Thesis
Stephen Lance Beber 1979 158 p
Avail: Univ. Microfilms Order No. 8000288

Several longitudinal factor models are reviewed in a unified notational system. This is followed by the presentation of the stationarity model (stationarity indicating the manifestation of cross occasion stability in the variables resulting in a constant or stationary factor pattern over time). Confirmatory and explorational concepts are compared as a means for applied research. An explorational technique is developed that estimates the parameters of the stationarity model. In a two part procedure, a stepwise algorithm is depicted that provides prerequisite values for a means of direct estimation. Four data sets, representing a variety of psychological measures collected over periods of up to 40 years, are used to test the technique. The explorational estimation procedure is found to be successful in classifying the factors from an initial image analysis, and is shown to be internally consistent. Dissert. Abstr.

N80-17803# Naval Postgraduate School, Monterey, Calif.
THE USE OF THE EMPIRICAL PROBABILITY GENERATING FUNCTION TO ESTIMATE THE NEYMAN TYPE A DISTRIBUTION PARAMETERS M.S. Thesis
Harold R. Bishop Sep. 1979 86 p refs
(AD-A076577) Avail: NTIS HC A05/MF A01 CSCL 12/1

The Maximum Likelihood estimators for the Neyman Type A distribution parameters are very difficult to compute. In this thesis, the Empirical Probability Generating Function is used to provide estimators that are easier to compute and have asymptotic efficiency at least as high as 97% of that for the Maximum Likelihood estimators over most of the parameter space considered. The estimators found by this method are consistently better than the Method of Moments and the Method of Zero Frequency estimators with respect to asymptotic efficiency.

The considerations of preference in using one method over another are discussed. GRA

N80-17804# Iowa Univ., Iowa City. Div. of Educational Psychology.

LOCAL AND REGIONAL COHERENCE UTILITY ASSESSMENT PROCEDURES

Melvin R. Novick, David T. Chuang, and Dennis F. Dekeyrel Jul. 1979 34 p refs
(Contract N00014-77-C-0428)
(AD-A076531; TR-79-7) Avail: NTIS HC A03/MF A01 CSCL 12/1

Novick and Lindley (1978, 1979) have dealt with the use of utility functions for applications in education and have advocated the use of the standard gamble (von Neumann and Morgenstern, 1953) elicitation procedure with the addition of coherence checking using overspecification and a least squares fit. In this procedure utilities are inferred from probability judgements offered by the assessor. This paper describes local and regional coherence procedures which seek utility coherence in successive restricted domains of the parameter space as preludes to overall coherence checking. These procedures and some others are viewed as possible ways of avoiding anchoring and certainty effect biases found in earlier fixed probability methods, and presumably present in current fixed state procedures. GRA

N80-17805# California Univ., Berkeley. Operations Research Center.

OPTIMAL LIST ORDER UNDER PARTIAL MEMORY CONSTRAINTS

Y. C. Kan and Shelton M. Ross Mar. 1979 27 p refs
(Contract N00014-77-C-0299; Grant AF-AFOSR-3213-77)
(AD-A077139; ORC-79-4) Avail: NTIS HC A03/MF A01 CSCL 12/1

The problem of interest is to determine the optimal ordering so as to minimize the long run average cost. Clearly if the P sub i were known, the optimal ordering would simply be to order the elements in decreasing order of the P sub i's. In fact even if the P sub i's were unknown we could do as well asymptotically by ordering the elements at each unit of time in decreasing order of the number of previous requests for them. In this paper we first consider the case in which the only memory allowed at any time is the ordering of the elements at that time; in other words, the only type of reordering rules we allow are ones in which the reordered permutation of elements at any time is only allowed to depend on the present ordering and the position of the element requested. We also consider the above problem under the premise that additional memory is allowed. In particular we allow the decision-maker to utilize such rules as 'only make a change (according to some preassigned rule) if the same element has been requested k times in a row.' We show that as k approaches infinity we can do as well as if we knew the values of the P sub i, and in addition we show that the convergence is monotone. GRA

N80-17806# Iowa Univ., Iowa City. Div. of Educational Psychology.

AN IMPROVED MODEL AND COMPUTER PROGRAM FOR BAYESIAN M-GROUP REGRESSION Research Report, Oct. 1978 - Mar. 1979

Ivo W. Molenaar and Charles Lewis Mar. 1979 62 p refs
(Contract N00014-77-C-0428; RR0420401)
(AD-A075393; TR-79-5) Avail: NTIS HC A04/MF A01 CSCL 12/1

This paper presents a modified model and computer algorithm for the estimation of regressions in m-groups. The major features of the new approach are: (1) The use of parameters with constant values for slopes across groups whenever the prior or the data indicate that this is desirable, (2) the use of a residual variance constant across groups, (3) independent priors for regression parameters, (4) scales of the predictors at the grand mean rather than at the so-called 'ideal scaling points', (5) transformation of all variables including the criterion to mean zero and variance one at the start of the calculations, (6) an improved search procedure for finding the mode of the posterior distribution. This new solution provides a greatly speeded-up algorithm which defines the posterior mode precisely. GRA

N80-17807# Wisconsin Univ. - Madison. Mathematics Research Center.

SAMPLING AND BAYES INFERENCE IN THE ADVANCEMENT OF LEARNING

George E. P. Box Jun. 1979 33 p refs
(Contract DAAG29-75-C-0024)
(AD-A077100; MRC-TSR-1969) Avail: NTIS HC A03/MF A01 CSCL 12/1

Sampling theory inference (e.g., inference based on sampling distributions of statistics and in particular on significance tests) and Bayesian inference are usually thought of as rivals and much effort has been spent in propounding their relative merits. In this paper it is argued that both kinds of inference are needed in the scientific iteration whereby knowledge is acquired. This iteration employs a directed alternation between induction and deduction which uses model criticism on the one hand and parameter estimation on the other. An analysis of Bayes' formula reveals model criticism as a sampling theory concept and parameter estimation as a Bayesian concept. The implications of these ideas for robust estimation are discussed. GRA

N80-17808# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.

ON THE STRUCTURE OF STATIONARY FLAT PROCESSES 2

Olav Kallenberg 1979 32 p refs
(CTH-Math-1979-18) Avail: NTIS HC A03/MF A01

An attempt is made to prove, under weakest possible assumptions, that a stationary random measure eta or a simple point process Xi on the space of k-flats in R sup d is a.s. invariant or a Cox process, respectively. The problems for Xi and eta are related by the fact that Xi is Cox whenever the Papangelou conditional intensity measure zeta of a thinning of Xi is a.s. invariant. In particular, eta is shown to be a.s. invariant whenever it is absolutely continuous with respect to some fixed measure eta and has no outer degenerates. When k = d - z > or = z no absolute continuity is needed, provided that the first moments exist and that eta has no inner degeneracies either. It is further shown that, under a certain regularity condition on Xi, Xi, and zeta simultaneously nondegenerate in either sense. Author (ESA)

N80-17809# Loughborough Univ. of Technology (England). Dept. of Mathematics.

A SIMPLE CUSUM TYPE STATISTIC FOR THE CHANGE-POINT PROBLEM WITH ZERO-ONE OBSERVATIONS

A. N. Pettitt Jul. 1978 18 p refs
(Maths-Res-128) Avail: NTIS HC A02/MF A01

A simple cumulative sum (CUSUM) type statistic for the change point with zero-one observations is introduced. A conditional test of no change against change is derived and compared with a likelihood ratic test. The simple test statistic performs well in a small sample simulation. Also, the estimation of the change point is considered using the simple statistic and shown to be asymptotically equivalent to the maximum likelihood estimator in certain circumstances and almost equivalent in others. Simulation experiments investigating the small sample behavior, show the simple CUSUM type estimator to be generally superior to the maximum likelihood estimator. Author (ESA)

N80-17810# Loughborough Univ. of Technology (England). Dept. of Mathematics.

SOME RESULTS ON ESTIMATING A CHANGE-POINT USING NON-PARAMETRIC STATISTICS

A. N. Pettitt Nov. 1979 26 p refs
(Maths-Res-132) Avail: NTIS HC A03/MF A01

A general class of statistics, derived from a Mann-Whitney-Wilcoxon two sample statistic, for estimating the change point in a sequence of random variables is considered. These statistics should perform well when the underlying populations are not normal but are long-tailed. Some asymptotic results are discussed and comparisons of a simple non-change point are made. Some Monte Carlo results are also reported to give some indication of small sample behavior. The nonparametric statistic performs well under the assumption of long-tailed distributions. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-17811# Army Inventory Research Office, Philadelphia, Pa.
SYSTEM AVAILABILITY WITH REDUNDANCY AND SPARES
Alan J. Kaplan Jul. 1979 37 p refs
(AD-A073743; IRO-TR-79-4) Avail: NTIS HC A03/MF A01 CSCL 15/5

This report discusses evaluation of expected steady state system availability when there is parallel redundancy and a pool of spares. The pool may support more than one system. Exact results are obtained for both warm standby and cold standby cases, assuming component installation time is 0. Approximations are suggested for treating non-zero installation time. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-17812# Stanford Univ., Calif. Dept. of Psychology.
PREFERENCE TREES Technical Report, 1 Dec. 1978 - 1 Oct. 1979
Amos Tversky and Shmuel Sattath 1 Oct. 1979 91 p refs
(Contract N00014-79-C-0077)
(AD-A076024; TR-1) Avail: NTIS HC A05/MF A01 CSCL 12/1

This paper develops a probabilistic choice model, called Preference Tree or Pretree, which describes choice as a covert hierarchical elimination process. Each alternative is represented as a measurable collection of aspects and the entire ensemble of aspects is assumed to have a tree structure. At each stage one selects an aspect (i.e., a branch of the tree) with probability that is proportional to its measure and eliminates all the alternatives that do not belong to the selected branch. The process continues until only a single alternative remains. Pretree is considerably more parsimonious than the more general model of Elimination-by-Aspects (EBA) because it has at most 2n rather than 2 to the nth power parameters, where n is the number of choice alternatives. At the same time, Pretree is much less restrictive than models (e.g., Luce, 1959) which assume that the strength of preference of x over y is independent of other alternatives. It is shown that the proposed model, which is based on random selection of aspects, is also compatible with a different decision strategy in which the aspects are considered in a fixed sequential order. Finally, Pretree is applied to the analysis of choice that is constrained by a partition imposed on the offered set (e.g., an agenda). It is shown that choice probabilities are unaffected by constraints if and only if the constraints are compatible with the structure of the tree. The effect of an agenda on individual choice is investigated experimentally, and its implications to committee decision making and consumer behavior are discussed. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-17813 Stanford Univ., Calif.
INSTANTANEOUS KINEMATIC PROPERTIES OF POINT AND LINE TRAJECTORIES Ph.D. Thesis
Jon Michael McCarthy 1979 139 p
Avail: Univ. Microfilms Order No. 8001968

The instantaneous kinematics of moving rigid bodies is discussed. The differential geometry of curves and surfaces is used to derive functions describing the shape of point and line trajectories in the vicinity of a reference position. These functions are then used to tie the geometric characteristics of point and line trajectories directly to the representation of a motion in terms of the set of numbers known as the instantaneous invariants of the motion. A description of the shape of point trajectories, to the third order, is obtained for planar and spherical motion. For spatial motion, in addition to the study of point trajectories, the third order properties of trajectories generated by lines in the moving body are examined. Dissert. Abstr.

N80-17814# North Carolina Univ. at Chapel Hill. Dept. of Chemistry.
MAGNETISM OF MIXED VALENCE COMPOUNDS
William E. Hatfield 1 Oct. 1979 53 p refs
(Contract N00014-76-C-0816; NR Proj. 053-617)
(AD-A075804; TR-8) Avail: NTIS HC A04/MF A01 CSCL 20/3

Results of representative studies of magnetic properties of mixed valence compounds are described in terms of Heisenberg-Van Vleck-Dirac exchange theory, which is developed. Systems of discrete clusters, chains, sheets, and three dimensinal polymeric materials are discussed. Several important problems requiring additional research are identified. GRA

N80-17815# Montpellier Univ. (France). Dept. of Physique Mathematique.
ON EXTREMAL SOLUTIONS OF STURM-LIOUVILLE INVERSE PROBLEMS
Pierre C. Sabatier Jan. 1979 10 p refs
(PM/79/6) Avail: NTIS HC A02/MF A01

The problem of reconstructing the density p(x) of a vibrating string given the N first eigenfrequencies of two vibrating configurations admits solutions that minimize certain weighted averages of the density. The expansions of functions on the squares of eigenfunctions gives a simple set of necessary conditions on these weights. In particular, it is shown that the only weight functions f(x) that are consistent in all cases with the existence of an extremal density, made up of a finite number of point masses, are polynomials of degree two. Author (ESA)

N80-17816# Research Inst. of National Defence, Linkoeping (Sweden).
STABILITY AND DISPERSION MEASUREMENTS OF PROJECTILES WITH DIFFERING WHEELBASES [STABILTETSMAATNING OCH SPRIDNINGSSKJUTNING AV PROJEKTILER MED OLIKER LAANG CYLINDRISK DGL]
Sven Nordstroem and Nils-Bertil Nilsson Mar. 1979 107 p refs In SWEDISH; ENGLISH summary
(FOA-C-20298-D2) Avail: NTIS HC A06/MF A01

Artillery projectiles of five different wheelbases were tested on a firing range for stability and dispersion at four velocities at long and short ranges. Drag measurements were made which shows that changing the wheelbase does not measureably alter the drag coefficient. The static stability factor S sub 0 depends strongly upon the wheelbase with measured values from 3.1 for the short projectile to 1.2 for the longest. In most cases the data were within the limits of static dynamic stability. During long range firings no statistically different dispersions were found. There was a weak correlation between S sub 0 and range dispersion. Author (ESA)

N80-17817# Montpellier Univ. (France). Dept. de Physique Mathematique.
AROUND THE CLASSICAL STRING PROBLEM
Pierre C. Sabatier Jun. 1979 18 p refs Presented at Intern. Meeting on Nonlinear Evolution Equations and Dynamical Systems, Lecce, Italy, 20-23 Jun. 1979
(PM/79/14) Avail: NTIS HC A02/MF A01

The problem of reconstructing the density rho(x) of a vibrating string given the N first eigenfrequencies of two vibrating configurations admits solutions that minimize certain weighted averages of the density. There exists a simple set of necessary conditions of these weights. In particular, it is shown that the only weight functions f(x) that can be consistent in all cases with the existence of an extremal density which is made up of a finite number of point masses are polynomials of degree two. It is shown that the weighted averages can be calculated exactly. Explicit formulas are given which in certain cases depend only on the spectrum of one vibrating configuration. The results strongly suggest applications to the Earth inverse problem. They are also extended to other problems which suggest applications to nonlinear questions. In particular, a nonlinear evolution equation is studied and conservation laws are discussed. Author (ESA)

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution.*

N80-17818 Stanford Univ., Calif.
HIGH PERFORMANCE ELECTRONICS FOR ULTRASOUND IMAGING Ph.D. Thesis
Michael David Eaton 1979 151 p
Avail: Univ. Microfilms Order No. 8001908

The development of a computer controlled preprocessor based on a cascade charge coupled device (C3D) electronic lens is discussed. Motivation is presented for use of the system beam pattern (impulse response) as a quantitative performance measure. It is shown that spurious responses (sidelobes/grating lobes) are the primary limitation in diagnostic imaging. Asynchronous charge transfer within the C3D is modeled and analyzed, producing simple design formulas for applying the device to real scanners. Aperture apodization experiments which reveal substantial improvements in sidelobe/background levels are described. Dissert. Abstr.

N80-17819 Pennsylvania Univ., Philadelphia.
THE COHERENCE OF ACOUSTIC SIGNALS IN THE OCEAN AND APPLICATION TO THE DESIGN OF VERY LARGE ARRAYS Ph.D. Thesis
William John Graham 1979 179 p
Avail: Univ. Microfilms Order No. 7928134

A solution to the coherence between underwater acoustic signals in multipath channels which have uncorrelated random fluctuations is presented. The multipath coherence function (MCF) is applied to the design of a very large array (VLA) composed of widely spaced subarrays. The solution is developed in terms of ensemble averages of the random channel transfer functions. The oceanographic fluctuations considered in the MCF are internal waves, internal tides, spatial phase variations due to multipath interference, and frequency selective multipath interference. The relative effects of these fluctuations are compared. The theory predicts VLA signal to noise gain, resolution ability, and scanning ability for specified system configuration, multipath characteristics, and parameters of environmental fluctuations. A VLA system design approach is proposed and considerations in system implementation are analyzed. Dissert. Abstr.

N80-17820 Stanford Univ., Calif.
ACOUSTIC MICROSCOPY AT OPTICAL WAVELENGTHS Ph.D. Thesis
Victor Burr Jipson 1979 204 p
Avail: Univ. Microfilms Order No. 8001944

A scanning reflection acoustic microscope that utilizes acoustic waves with optical wavelengths is evaluated. The design of the instrument is discussed with particular attention paid to the acoustic lens element. The design and fabrication of efficient high frequency acoustic transducers and matching layers are described. An optical technique that allows the lens to be properly illuminated is discussed and the problem of acoustic diffraction and beam steering in the anisotropic lens element is considered. The RF electronics necessary for this instrument are described and signal to noise considerations evaluated. A technique is described for studying contrast changes in acoustic images as a function of lens object spacing. The use of the acoustic microscope to image interior planes within a solid is considered. In particular, the use of liquid metals as a replacement for water as the acoustic coupling media is examined. Dissert. Abstr.

N80-17821# National Research Council of Canada, Ottawa (Ontario).
EFFECTS OF WIND SPEED DISTRIBUTION ON THE PROPAGATION OF SOUND
Nobuhara Aoshima 1980 21 p refs Transl. into ENGLISH from Nihon Onkyogakkaishi Japan, v. 34, no. 5, 1978 p 308-315
(NRC/CNR-TT-1959; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

While sound attenuates when traveling against the wind, a rise is observed in the sound pressure level if the wind is behind. The fluctuation in these instances sometimes amounts to as much as several bels. An approach to calculating the sound field is described which takes into consideration the wave character of sound and accounts for the frequency characteristics of the attenuation that occurs. The method is essentially based on Fresnel's theory in optics, but introduces to this theory the concept that wind produces a phase shift in sound waves. A.R.H.

N80-17822# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics.
AN ANALYSIS OF TRANSVERSE MODES IN ACOUSTIC SURFACE WAVE RESONATORS
B. K. Sinha and H. F. Tiersten Sep. 1979 54 p refs
(Contract N00014-76-C-0368)
(AD-A077067; RPI-TR-29) Avail: NTIS HC A04/MF A01 CSCL 20/1

A system of approximate surface wave equations employed in an earlier treatment of the reflection of straight-crested surface waves by arrays of reflecting strips is extended to the case of variable-crested surface waves. Although the basic straight-crested surface wave velocities are determined as in the previous treatment, in the present case a reduction in straight-crested surface wave velocity in the unplated region due to the adjacent plated regions, which is essential for the existence of the guided transverse modes, is determined by means of a perturbation procedure. The attendant depth dependence for each region is employed in the variational principle as in the earlier treatment, but now the variable cresting relation for the isotropic substrate is incorporated in the description. The resulting equations are applied in the determination of both the transverse modes in each region and the transmission line representation of each mode. The transverse wave numbers in a given mode are taken to be the same in the plated and unplated regions in order that the interior edge conditions be satisfied pointwise. The system of parallel transmission lines is applied in the analysis of the reflection of variable-crested surface waves by uniformly spaced arrays. The response to a rectangular input of a particular reflecting array consisting of aluminum reflecting strips on ST-cut quartz is calculated and compared with measurements. GRA

N80-17823# Naval Underwater Systems Center, New London, Conn.
EFFECTS OF RANDOM SHADING, PHASING ERRORS, AND ELEMENT FAILURES ON THE BEAM PATTERNS OF LINE AND PLANAR ARRAYS
Azizul H. Quazi, H. Azizul, and Albert H. Nuttall 17 Sep. 1979 14 p refs
(AD-A076494; NUSC-TD-6103) Avail: NTIS HC A02/MF A01

The effects of random shading, phasing errors, and element failures on the beam patterns of line and planar arrays are investigated. The results indicate that the effects of element failures and random phasing errors on the beam pattern are more pronounced than the effect of shading errors. The deep side lobe level, in both line and planar arrays, is critically affected by random errors that include shading, phasing, and element failures. The combined effect of random shading, phase, and element failures on the beam pattern of a line array is more dramatic than it is on the beam pattern of a planar array. GRA

N80-17824# George Washington Univ., Washington, D. C. School of Engineering and Applied Science.
RESEARCH ON HELICOPTER ROTOR NOISE Final Report, 1 Jun. 1976 - 30 Sep. 1979
H. Liebowitz and F. Farassat Oct. 1979 13 p refs
(Grants DAAG29-78-G-0152; DAAG29-76-G-0259)
(AD-A075259; ARO-13517.3-EX) Avail: NTIS HC A02/MF A01 CSCL 20/1

This report summarizes the results of studies in the following areas: (1) applications of generalized functions to aeroacoustics and aerodynamic problems, (2) bounds on thickness and loading noise of rotating blades and the effects of blade sweep on reduction of the noise of rotating blades, (3) study of nonlinear effects relevant to the rotor noise problem and (4) computational aspects of high speed rotor noise. GRA

N80-17825# Texas Univ. at Austin. Applied Research Labs.
LABORATORY AND FIELD STUDIES OF SEDIMENT ACOUSTICS Annual Report, 1 Jan. - 31 Dec. 1978
Donald J. Shirley, David W. Bell, and Jens M. Hovem Jun. 1979 137 p refs
(Contract N00014-76-C-0117)
(AD-A075833; ARL-TR-79-26) Avail: NTIS HC A07/MF A01 CSCL 20/1

Work under Contract consisted of threu parts 1 redesign and updating of the ARL UT profilometer system used to measure in situ sound velocities of ocean bottom sediments, 2 development of transducers to measure shear wave and acoustic impedance parameters of sediments, and 3 laboratory measurements to develop and confirm theoretical models for acoustic propagation in sediments. Data obtained for the three parts of the program are reported. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-17826# New York Univ., N. Y. Dept. of Physics.
THEORY OF COLLISIONALLY AIDED RADIATIVE EXCITATION IN THREE-LEVEL SYSTEMS: A NEW INTERFERENCE EFFECT
S. Yeh and P. R. Berman 23 May 1979 8 p refs
(Contract N00014-77-C-0553)
(AD-A076101) Avail: NTIS HC A02/MF A01 CSCL 07/4

Collisionally Aided Radiative Excitation in a three-level atomic system is investigated using a stationary phase method for the case of large atom-field detunings and weak incident fields. It is found that collision-induced coherent phase interference effects can give rise to oscillatory structure in the total absorption cross section as a function of relative speed (energy). An example is given for a specific interatomic potential, indicating that experimental observation of such an effect is feasible. GRA

N80-17827# New York Univ., N. Y. Dept. of Physics.
THE EFFECTS OF VELOCITY-CHANGING COLLISIONS ON TWO-PHOTONS AND STEPWISE ABSORPTION SPECTROSCOPIC LINESHAPES
P. R. Berman, P. F. Liao, and J. E. Bjorkholm Sep. 1979 23 p refs
(Contract N00014-77-C-0553)
(AD-A076100) Avail: NTIS HC A02/MF A01 CSCL 07/4

We report the results of an experimental study of the effects of velocity-changing collisions on two-photon and stepwise absorption lineshapes. Excitation spectra for the 3S(1/2) yields 3P(1/2) yields 4D(3/2) transitions of sodium atoms undergoing collisions with foreign gas perturbers are obtained. These spectra are obtained with two cw dye lasers. One laser, the pump laser, is tuned 1.6 GHz below the 3S(1/2) yields 3P(1/2) transition frequency and excites a nonthermal longitudinal velocity distribution of excited 3P(1/2) atoms in vapor. Absorption of the second (probe) laser is used to monitor the steady state excited state distribution which is a result of collisions with rare gas atoms. The spectra are obtained for various pressures of He, Ne, and Kr gases and are fit to a theoretical model which utilizes either the phenomenological Keilson-Stoerer or the classical hard sphere collision kernel. The theoretical model includes the effects of collisionally aided excitation of the 3P(1/2) state as well as effects due to fine-structure state-changing collisions. Although both kernels are found to predict lineshapes which are in reasonable agreement with the experimental results, the hard sphere kernel is found superior as it gives a better description of the effects of large angle scattering for heavy perturbers. Neither kernel provides a fully adequate description over the entire line profile. The experimental data is used to extract effective hard-sphere collision cross sections for collisions between sodium 3P(1/2) atoms and helium, neon and krypton perturbers. GRA

N80-17828# New York Univ., N. Y. Dept. of Physics.
STUDY OF COLLISIONAL REDISTRIBUTION USING TWO-PHOTON ABSORPTION WITH A NEARLY RESONANT INTERMEDIATE STATE
P. R. Berman, P. F. Liao, and J. E. Bjorkholm Sep. 1979 14 p refs
(Contract N00014-77-C-0553)
(AD-A076099) Avail: NTIS HC A02/MF A01 CSCL 07/4

We report studies of collision-induced features of the 3S(1/2) yields 3P(1/2) yields 4D(3/2) two-photon absorption in atomic sodium vapor undergoing collisions with several rare gas perturbers. The results yield the collisional redistribution function which describes the nonresonant excitation of the 3P(1/2) intermediate state. Good agreement with theory is obtained only if effects of 3P(1/2) in equilibrium with 3P(3/2) state-changing collisions are included in the calculations. Results are used to obtain a value for a pressure broadening coefficient in the Na-Kr system. GRA

N80-17829# Naval Research Lab., Washington, D. C.
GENERATION OF HIGH ENERGY-HIGH CURRENT ION PULSES BY MAGNETIC COMPRESSION OF ION RINGS Interim Report
C. A. Kapetanakos 24 Oct. 1979 34 p refs
(AD-A076200; AD-E000333; NRL-MR-4093) Avail: NTIS HC A03/MF A01 CSCL 20/7

A scheme is proposed for the generation of intense, high energy ion pulses by magnetic compression of ion rings. After compression the ring is extracted through a half magnetic cusp that transforms an appreciable fraction of the ring's rotational energy to translational energy. The existence of equilibrium of a hollow, rotating beam in the absence of an external magnetic field and a conducting guide tube was shown using the Vlasov-Maxwell approach. Therefore, the proposed scheme appears to be in particular useful for those applications that require a large separation between the accelerator and the target. GRA

N80-17830# IRT Corp., San Diego, Calif.
MOLECULAR BEAM STUDIES OF LOW ENERGY REACTIONS Annual Report
R. H. Neynaber and S. Y. Tang 15 Oct. 1979 5 p refs
(Contract N00014-74-C-0011)
(AD-A075394; IRT-8103-009) Avail: NTIS HC A02/MF A01 CSCL 20/7

The annual summary of the research performed under ONR Contract No. N00014-74-C-0011 is given. The report describes merging and crossed-beam studies of chemi-ionization and/or ion-molecule reactions. Included are investigations of the He(*) - D, Ne(*) - Xe, Ar(*) - Kr(*), Ne(*) - Ar(*), He(+) - Ne(*), and Kr(+) - Cs systems. A description is also given of how this research helps resolve unknown aspects of the areas investigated. GRA

N80-17831# SRI International Corp., Menlo Park, Calif.
METASTABLE RARE GAS COLLISIONS WITH MOLECULES Summary Questionnaire, Oct. 1978 - Oct. 1979
Keith T. Gillen 15 Oct. 1979 6 p refs
(Contract N00014-76-C-0734)
(AD-A076022) Avail: NTIS HC A02/MF A01 CSCL 07/2

This report summarizes recent progress in an experimental investigation of reactive and inelastic scattering of fast metastable rare gas atoms by various target molecules. Detailed investigations have been made of reactons between He *(2 to the first power s), He*(2 to the 3rd power s), and Ar* projectiles and O2 target molecules. Collisional ion-pair formation differential cross sections and electronically and vibrationally inelastic cross sections have been emphasized. Classical trajectory calculations on diabatic potential surfaces have been used to model and interpret the experimental results. GRA

N80-17832# Hebrew Univ., Jerusalem (Israel). Dept. of Chemistry.
ELECTRONIC EXCITATION IN MOLECULAR COLLISIONS: STRUCTURAL, DYNAMIC AND KINETIC CONSIDERA-

TIONS Annual Summary Report, Sep. 1978 - Aug. 1979
R. D. Levine Sep. 1979 9 p
(Grant N00014-78-G-0036)
(AD-A074955) Avail: NTIS HC A02/MF A01 CSCL 20/10

The factors governing chemical reactivity with special reference to the role of electronic energy is promoting the reaction and to the production of electronically excited species are examined. The problem is studied both in general terms (i.e., the development of the required theoretical framework) and in application to specific systems. GRA

N80-17833# Sandia Labs., Albuquerque, N. Mex. Applied Physics Div.
SNEER: A DIGITAL COMPUTER PROGRAM FOR THE SIMULATION OF CHARGED PARTICLE BEAMS AND ELECTROSTATIC LENSES
J. E. Boers Jul. 1979 35 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0597) Avail: NTIS HC A03/MF A01

The SNEER program is found to be powerful tool for the analysis of charged particle beams and trajectories. Inclusion of relativistic trajectory computations and the ability to include dielectrics in the potential relaxation enables the program to handle virtually any type of beam configuration not including a source - such as a cathode. Examples shown have produced results within a few percent of exact theoretical and experimental results. A sample input data set is presented for still another application of the program. Trapped electron orbits are traced in electric and magnetic fields in an ion gauge configuration. DOE

N80-17834# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
THE REACTION OF O(1D) WITH WATER [UNTERSUCHUNG DER REAKTION VON O(1D)-ATOMEN MIT H2O]
K. Kaufmann Dec. 1978 6 p refs In GERMAN
(MPIS-27/1978; ISSN-0436-1199) Avail: NTIS HC A02/MF A01; Fachinformationszentrum Karlsruhe, West Germany DM 3,60

The reaction of activated oxygen atoms (O-1D) with molecules was studied in the laboratory by means of a quadrupole mass spectrometer. This reaction, producing HZ and OZ molecules, contributes to reducing the concentration of activated oxygen atoms in the ionosphere produced by the ozone absorption of ultraviolet radiation. It is concluded that the contribution of this reaction to the deactivation of (O-1D) is less than 1.6% (+ or - 1%). Author (ESA)

N80-17835# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
MOLECULAR BEAM MEASUREMENTS OF INELASTIC CROSS SECTIONS FOR TRANSITIONS BETWEEN DEFINED ROTATIONAL STATES (jm) OF CsF IN COLLISIONS WITH He, Ne, Ar, Kr, AND Xe, CH4, SF6, C2H6, N2, CO, CO2, N2O, CH3Cl, CH3Br, CF3H, AND CF3Br
U. Borkenhagen, H. Malthan (IABG, Munich), and J. Peter Toennies Jan. 1979 86 p refs
(MPIS-5/1979; ISSN-0436-1199) Avail: NTIS HC A05/MF A01; Fachinformationszentrum Karlsruhe, West Germany DM 15,60

Absolute inelastic cross sections for rotational quantum state to state transitions were measured. Small angle grazing collisions of CsF molecules colliding with rare gas collision partners as well as with other scattering partners were studied. In the collision region the quantization axis of the CsF molecules is defined by a weak electric field (300 V/cm) directed perpendicular to the direction of the velocity selected CsF and the target nozzle beam. The apparatus, which uses electrostatic quadrupole fields to state select and state analyze the CsF molecules prior to and after scattering, is described. The formulas used to derive the various types of cross sections from the pressure dependences are derived. A transmission function for each rare gas and transition was calculated using a Monte Carlo method. Theoretical predicted differential cross sections were compared with the reported values. The cross sections were correlated with the predictions of a Born approximation theory for the various predominant potential terms. Author (ESA)

N80-17836# Loughborough Univ. of Technology (England). Dept. of Mathematics.
A PROBLEM WITH CLASSICAL NEUTRINO FIELDS IN GENERAL RELATIVITY
J. B. Griffiths Nov. 1978 17 p refs
(Maths-Res-133) Avail: NTIS HC A02/MF A01

Weak gravitational interactions with neutrinos are discussed. A general relativistic theory of neutrino fields is sought. The idealized neutrino which has zero rest mass, zero charge, and spin 1/2 is considered. There are two advantages to considering this idealized case. The neutrino is regarded as a semiclassical null field analogous to that for a photon and it simplifies the mathematics. The implications of this anomaly and its associated properties on the theory are emphasized. Author (ESA)

N80-17837# Montpellier Univ. (France). Dept. de Physique Mathematique.
BEHAVIOR OF SIGMA (POSITRON-ELECTRON YIELDS OMEGA MESON-ANTI-OMEGA-MESON) NEAR THE THRESHOLD INCLUDING FINITE WIDTH EFFECTS
J. Layssac May 1979 6 p refs
(PM/79/13) Avail: NTIS HC A02/MF A01

In high energy electron-positron collisions the production of omega-mesons and anti-omega-mesons is a very crucial test of unified theories of weak and electromagnetic interactions. After a brief consideration of the computed cross section of omega-meson and anti-omega-meson production according to the Weinberg-Salam model, the effects on boson production due to omega prime width are studied. Results are used to compute the cross section sigma (positron-electron yields omega-meson-anti-omega-meson) before the threshold. It is shown that 10 GeV before the opening of the channel omega-meson and anti-omega-meson the cross section is about 10 percent of its maximum value (0.18 x 10 to the -8 power mb). Author (ESA)

N80-17838# Istituto Superiore di Sanita, Rome (Italy). Lab. delle Radiazioni.
RADIATION PROTECTION PROBLEMS RELATED TO PARTICLE ACCELERATORS WITH SPECIAL EMPHASIS ON THE START UP AUTHORIZATION PROCEDURE REQUIRED BY ITALIAN LAW
A. Baroncelli (INFN Sez. Sanita), M. Belli, S. Benassi (Direzione Centrale Sicurezza Nucl. e Protezione Sanitaria), C. Bosio (INFN Sez. Sanita), M. Paganini-Fioratti (Direzione Centrale Sicurezza Nucl. e Protezione Sanitaria), and M. Pelliccioni (Lab. Nazl. di Frascati, Italy) 1 Dec. 1978 72 p refs In ITALIAN; ENGLISH summary
(ISS-T-78/15) Avail: NTIS HC A04/MF A01

A guideline based on practices in Italy and aimed at ensuring radiation protection around particle accelerators is given. Radiation hazards to living organisms are examined. An evaluation of the hazards is presented. Pertinent laws and regulations stemming from the evaluation of risk are reviewed. Particle accelerator characteristics are listed and the types and intensity of radiation likely to be encountered using the equipment are shown. Author (ESA)

N80-17839# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
APPLICATION OF THE MOLECULAR BEAM TECHNIQUE TO THE GROWTH OF ALKALI METAL ANTIMONIDE PHOTOCATHODES: STUDY OF THE GROWTH KINETICS Final Report [APPLICATION DE LA TECHNIQUE DES JETS MOLECULAIRES A L'ETUDE DE LA CINETIQUE DE CROISSANCE DES PHOTOCATHODES D'ANTIMONIURES ALCALINS]
G. Marie 1 Mar. 1977 45 p refs In FRENCH
(Contract DGRST-77-7-0084)
(LEP-79/510.SME-619-B) Avail: NTIS HC A03/MF A01

Alkali metal source generators, developed to use with a molecular beam technique for the fabrication of photocathodes (Sb, Na, K, Cs) are discussed. The simultaneous use of the different sources makes it possible to obtain homogeneous, pure layers whose stoichiometry is controlled by regulating the sources. As the chemical reactions between the elements only occur on the substrate, the technique provides a simple means of controlling crystal layer growth. Results obtained in the growth of trialkali photocathodes are shown to be reproducible while characterization of the fabricated materials indicates the value of the technique for the development of photocathodes with high photoelectric sensitivity. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N80-17840 California Inst. of Tech., Pasadena.
SINGLE-AND MULTIPLE-SCATTERING MECHANISMS IN HIGH-ENERGY NUCLEAR COLLISIONS Ph.D. Thesis
Robert Lee Hatch 1980 126 p
Avail: Univ. Microfilms Order No. 8002587

The production of energetic protons from relativistic nuclear collisions was studied using two approaches, the hard scattering model and an intranuclear cascade model. The hard scattering model combines the simplified kinematics of single scatterings and the effects of the momentum distribution for nucleons in the nucleus to provide a parameter free description of a nucleus-nucleus collision. Free nucleon-nucleon cross sections were used to describe the individual NN interactions. The model is also applied to explain the observed two proton azimuthal correlations from these systems and, with simple assumptions, to estimate the single scattering component of the inclusive proton spectra. Calculations of the one and two particle inclusive spectra are presented using forms for the momentum distribution obtained both from the analysis of proton-nucleus backscattering data and from theory. A simple cascade model was used to calculate the inclusive proton spectra at 180 degrees from 600 MeV proton-nucleus collisions. Dissert. Abstr.

N80-17841*# United Technologies Research Center, East Hartford, Conn.
SPECTRAL PROPERTIES OF GASEOUS URANIUM HEXAFLUORIDE AT HIGH TEMPERATURE
N. L. Krascella Washington NASA Feb. 1980 29 p refs
(Contract NAS1-14329)
(NASA-CR-3244; R79-912869-1) Avail: NTIS HC A03/MF A01 CSCL 20I

A study to determine relative spectral emission and spectral absorption data for UF6-argon mixtures at elevated temperatures is discussed. These spectral data are required to assist in the theoretical analysis of radiation transport in the nuclear fuel-buffer gas region of a plasma core reactor. Relative emission measurements were made for UF6-argon mixtures over a range of temperatures from 650 to 1900 K and in the wavelength range from 600 to 5000 nanometers. All emission results were determined for a total pressure of 1.0 atm. Uranium hexafluoride partial pressures varied from about 3.5 to 12.7 mm Hg. Absorption measurements were attempted at 600, 625, 650 and 675 nanometers for a temperature of 1000 K. The uranium partial pressure for these determinations was 25 mm Hg. The results exhibit appreciable emission for hot UF6-argon mixtures at wavelengths between 600 and 1800 nanometers and no measurable absorption. The equipment used to evaluate the spectral properties of the UF6-argon mixtures included a plasma torch-optical plenum assembly, the monochromator, and the UF6 transfer system. Each is described. A.W.H.

N80-17842# Battelle Pacific Northwest Labs., Richland, Wash.
NUCLEAR WASTE MANAGEMENT STATUS AND RECENT ACCOMPLISHMENTS Final Report
J. L. McElroy and R. E. Burns May 1979 85 p refs Sponsored by Elec. Power Res. Inst.
(Contract EY-76-C-06-1830)
(EPRI-NP-1087) Avail: NTIS HC A05/MF A01

The status and technical progress of nuclear waste disposal is reviewed with emphasis on technical and programmatic progress in high level nuclear waste disposal technology during the 1976 to 1978 time period. Process steps in the waste solidification and geologic disposal system are described emphasizing processes and systems that are more advanced in terms of readiness for full scale demonstration. Technical accomplishments in support of the reference waste vitrification and geologic disposal approach are highlighted. DOE

N80-17843# National Technical Information Service, Springfield, Va.
LASER FUSION, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Oct. 1977 - Sep. 1979
Brian Carrigan Oct. 1979 231 p Supersedes NTIS/PS-78/1062; NTIS/PS-77/0865; NTIS/PS-76/0856; NTIS/PS-75/0783
(PB80-800246; NTIS/PS-78/1062; NTIS/PS-77/0865; NTIS/PS-76/0856; NTIS/PS-75/0783) Avail: NTIS HC $30.00/MF $30.00 CSCL 18A

The bibliography cites research on target fabrication, laser implosion instability, and laser produced plasma studies. The bibliography contains 225 abstracts, 107 of which are new entries to the previous edition. GRA

74 OPTICS

Includes light phenomena.

N80-17844 Dartmouth Coll., Hanover, N.H.
OPTICAL PROPERTIES AND STRUCTURE OF VANADIUM, NIOBIUM, TANTALUM, CHROMIUM, MOLYBDENUM, AND TUNGSTEN FILMS Ph.D. Thesis
James Ernest Nestell, Jr. 1979 233 p
Avail: Univ. Microfilms Order No. 8001173

The optical properties, dc resistivity, and microstructure are determined for V, Nb, Ta, Cr, Mo, and W evaporated thin films deposited onto elevated temperature (700-1000 C), room temperature, and cooled (77K) substrates. The film structures are investigated with X-ray and transmission electron diffraction and transmission electron microscopy probes. It is found that well-crystallized films are produced at the elevated temperatures, with grain sizes significantly greater than those of room-temperature depositions. The optical reflectance of opaque, well-crystallized Ta, Cr, Mo and W films is larger than for films deposited at room temperature. Dissert. Abstr.

N80-17845 Stanford Univ., Calif.
TUNABLE INFRARED GENERATION USING PARAMETRIC AND RAMAN PROCESSES Ph.D. Thesis
Stephen John Brosnan 1979 185 p
Avail: Univ. Microfilms Order No. 8001879

Methods of generating widely tunable infrared light using parametric and Raman processes are described. Detailed measurements are presented which establish the usefulness of an infrared source composed of a parametric oscillator and a Raman mixing frequency downconverter. The design of the LiNbO3 angle tuned parametric oscillator was optimized, and the measured performance characteristics were compared with theoretical models. Dissert. Abstr.

N80-17846 California Univ., Berkeley.
DIAGRAMMATIC AND FLOW GRAPH ANALYSIS OF THE DENSITY MATRIX FOR NONLINEAR OPTICAL CALCULATIONS Ph.D. Thesis
Ting Kwong Yee 1979 128 p
Avail: Univ. Microfilms Order No. 8000582

Two kinds of diagrammatic analyses of the density operator for the evaluation of nonlinear optical quantities are considered. The time evolution of both the wave function and its complex conjugate are treated by diagrammatic analysis. Examples involving the third-order susceptibility are discussed for both monochromatic and pulse excitation. The diagrams provide a convenient means by which nonlinear optical processes can be precisely defined and the susceptibility readily evaluated. Flow graphs are used to deduce Feenberg perturbation expansions for radiative interactions. Relevance to laser induced multiphoton excitation and energy level shift calculations in the presence of a strong field are also discussed. The flow graph technique is generalized to calculate density matrix elements. Examples involving the saturation phenomena of the first-order polarization and the TPRTHG are discussed. Dissert. Abstr.

N80-17847 California Univ., Berkeley.

INVESTIGATION OF SOME THIN-FILM SCHEMES FOR ELECTRO-OPTICS MODULATION AND DETECTION IN INTEGRATED OPTICS **Ph.D. Thesis**

Tirumala Ramakrishna Ranganath 1979 162 p
Avail: Univ. Microfilms Order No. 8000485

The operation of a symmetric fork waveguide structure was analyzed using simple symmetry arguments. It was found that an embedded ridge fork waveguide structure behaved as a mode order converter and not as a simple beam splitter. As a consequence, an interferometric modulator incorporating symmetric fork waveguides should function as a true amplitude modulator only if the individual arms of the structure were single mode waveguides. Such a structure was realized experimentally using Ti-diffused LiNbO3 embedded ridge waveguides. Measurements indicated that the device's operation does depend on the mode order converting behavior of single mode symmetric fork waveguides. Light detection in dielectric waveguides through direct evanescent coupling to an etched mesa photodiode was examined. A mesa diode was used in conjunction with a simple branched waveguide modulator (fabricated using Ti-diffused LiNbO3 waveguide structures) to demonstrate the scheme. Experimentally determined quantum efficiency of the photo diode was compared to the theoretically determined value. An experimental structure consisting of a 300 angstrom buffer layer of air between the LiNbO3 waveguide and the silicon mesa diode ia discussed. Dissert. Abstr.

N80-17848*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

FIBER-OPTIC INSTRUMENTATION: CRYOGENIC SENSOR MODEL DESCRIPTION **Final Report**

M. M. Sharma 25 Nov. 1979 20 p
(Contract NAS9-15454)
(NASA-CR-160448; TR-A001) Avail: NTIS HC A02/MF A01 CSCL 20F

An assessment and determination of technology requirements for developing a demonstration model to evaluate feasibility of practical cryogenic liquid level, pressure, and temperature sensors is presented. The construction of a demonstration model to measure characteristics of the selected sensor and to develop test procedures are discussed as well as the development of an appropriate electronic subsystem to operate the sensors. M.M.M.

N80-17849# New York Univ., N. Y. Dept. of Physics.

SOLVABLE MODEL FOR OPTICAL AND RADIATIVE COLLISIONS

E. J. Robinson Sep. 1979 7 p refs
(Contract N00014-77-C-0553)
(AD-A076102) Avail: NTIS HC A02/MF A01 CSCL 07/4

The related problems of optical and radiative collisions are examined theoretically. The actual R to the nth power potentials found in nature are simulated by powers of the hyperbolic secant, which enables one to obtain closed form solutions for the transition probabilities in the weak field regime. GRA

N80-17850# Photon Research Associates, Inc., La Jolla, Calif.

DEVELOPMENT AND VALIDATION OF STANDARDIZED INFRARED RADIATION MODEL (SIRRM): GAS/PARTICLE RADIATIVE TRANSFER MODEL **Computer Code Development Report, 8 Sep. 1978 - 30 Jun. 1979**

G. N. Freeman, C. B. Ludwig, W. Malkmus, and R. Reed Edwards AFB, Calif. AFRPL 30 Oct. 1979 173 p refs Prepared in cooperation with Grumman Aerospace Corp., Bethpage, N.Y.
(Contract F04611-78-C-0081; AF Proj. 3058)
(AD-A076199; AFRPL-TR-79-55) Avail: NTIS HC A08/MF A01 CSCL 20/6

Analytical models have been developed to treat the coupled gas/particle radiative transfer in exhaust plumes, monochromatically and in a band model approach. In addition, the availability of the particle optical parameters has been investigated. The requirements for the plume scattering model in SIRRM are: Coupled emission, absorption and scattering treatment; Multiple scattering with cylindrical geometry; Three-dimensional, non-uniform, axisymmetric medium; Arbitrary particle mixtures and size distribution; Line-by-line and band-model treatments; and Alternate levels of engineering approximation. These requirements are met by developing two basic approaches, a 6-flux and an N-flux approach. This distinction refers to the associated subdivision in angular space, six-orthogonal coordinates versus N nonorthogonal coordinates in azimuth and elevation, thus providing the alternatives of computational simplicity of the 6-flux model with generality of the N-flux model. Numerous parametric calculations were performed to study the effect of optical depth, scattering albedo, phase function and medium geometry on the target signature and computational requirements. GRA

N80-17851# Lincoln Lab., Mass. Inst. of Tech., Lexington.

ACCURACY REQUIREMENTS FOR GEODSS PHOTOMETRY

John M. Sorvari 26 Jul. 1979 44 p refs
(Contract F19628-78-C-0002; AF Proj. 2128)
(AD-A076496; ETS-47; ESD-TR-79-188) Avail: NTIS HC A03/MF A01 CSCL 20/6

Requirements on the accuracy of GEODSS photometry were derived based on the stated goals of GEODSS photometry. Fulfilling these requirements will ensure that the data are of sufficient quality for their intended purpose. Calculations based on the properties of the proposed system show that the requirements can be met if care is taken in the detailed design and data processing techniques. GRA

N80-17852# Illinois Univ. at Urbana-Champaign. Electromagnetics Lab.

GENERALIZED RAY OPTICAL ANALYSIS OF REFLECTION FROM A SMOOTH CONVEX CONDUCTING SURFACE

R. Mittra and A. M. Rushdi Oct. 1979 47 p refs
(Contract N00014-75-C-0293; Grant AF-AFOSR-3375-77)
(AD-A075278; UIEM-79-12; UILU-ENG-79-2556) Avail: NTIS HC A03/MF A01 CSCL 20/3

In certain applications involving reflection from smooth convex surfaces, the conventional geometrical optics method (GO) is not sufficiently accurate. In this paper a generalization of the conventional GO formulas is presented and closed-form expressions are derived. The derivation of the generalized geometrical optics (GGO) forumulas is based on the Fresnel transformation between two planes, one of which contains the spectral point, while the other passes through the observation point. The method developed herein improves the accuracy of GO with paying the high numerical cost of the physical optics integration. It is important, in particular, for computing the reflection characteristics of numerically specified surfaces. GRA

N80-17853# Thomson-CSF, Orsay (France). Lab. Centrale de Recherches.

STUDY OF THE APPLICATION OF THERMAL EFFECTS ON LIQUID CRYSTALS TO DEVICES FOR THE PROJECTION OF INFORMATION ON A SCREEN **Final Report** [ETUDE DE L'APPLICATION DES EFFETS THERMIQUES DANS LES CRISTEAUX LIQUIDES AUX DISPOSITIFS DE PROJECTION D'INFORMATION SUR ECRAN]

Serge LeBerre and Michel Hareng Dec. 1977 57 p refs In FRENCH Original contains color illustrations
Avail: NTIS HC A04/MF A01

The electro-optical and thermo-optical properties of liquid crystals were studied in order to develop a system for storing and displaying information. The system is based on an optical 'valve' and contains data as an array of points whose diffusivity to visible light can be changed. Light projected through the 'valve' is interpreted using Schlieren optics making possible a black and white display. Diffusion characteristics of the 'valve' can be completely, or locally, changed using a YAG laser. The data rate obtained with this device is 20,000 points/sec (200 characters/sec) with a contrast of 20.1. Author (ESA)

N80-17854# Officine Galileo S.p.A., Florence (Italy).

OPTICAL RATE SENSOR CONCEPT: EVALUATION STUDY **Final Report**

A. Buccheri Dec. 1978 183 p
(Contract ESTEC-3306/77-NL-AK(SC))
(Rept-401-DT-4; ESA-CR(P)-1238) Avail: NTIS HC A09/MF A01

The possibility of deriving angular rate information from randomly distributed celestial sources by methods involving spatial frequency filtering is analyzed. Measuring angular rates by imaging a star field on a detector and by using a spatial filter to transform image motion into a modulation of the detector output is discussed. The application of a reticle system, placed in the image plane of an objective lense looking at the star field from a spacecraft, is analyzed. A preliminary design of a system with no moving parts, three independent optical heads, and a single electronics box is described. Author (ESA)

N80-17856# Eurosat S.A., Geneva (Switzerland).
STUDY FOR THE DETERMINATION OF GEOMETRIC AND SPECTRAL RESOLUTION REQUIREMENTS OF OPTICAL IMAGING INSTRUMENTS FOR EARTH RESOURCES SATELLITES, VOLUME 1 Final Report
C. L. P. Miller May 1979 55 p
(Contract ESA-3529/78-F-HS(SC))
(CM/PR/3384-Vol-1; ESA-CR(P)-1239-Vol-1) Avail: NTIS HC A04/MF A01

A study aimed at establishing optimum values of sensor related parameters is reviewed. The history is traced from the original call for ideas to the final statements of objectives and proposed methodology. Recommendations for the activation of the study are made selecting three alternatives with various levels of constraint. Author (ESA)

N80-17856# Compagnie Generale d'Electricite, Marcoussis (France). Div. Materieux.
DEVELOPMENT OF LOW ATTENUATION GLASSES FOR OPTICAL TRANSMISSION APPLICATIONS Final Report [ELABORATION DE VERRES A FAIBLE ATTENUATION POUR LIASONS OPTIQUES]
C. LeSergent, J. Grosbois, and J. Portier Jun. 1978 24 p In FRENCH
(Contracts DGRST-76-7-07850; DGRST-76-7-0786; DGRST-76-7-0787)
Avail: NTIS HC A02/MF A01

Raw materials (silicon; sodium carbonate; calcium carbonate; boric acid) were refined and their applicability to the drawing of optical fibers was investigated. Glass fibers several kilometers in length, having an attenuation of 30 dB/km at 830 or 1060 nm, were drawn from the glasses SiOZ-Na2O-CaO and SiO2-B2O3-Na2O-B2O3. Following a study of the influence of diffusion on transmissivity and an improvement in fusion techniques, fibers were drawn from smaller sample batches having an attenuation of 10 plus or minus 1 dB/km for the same wavelengths. Fluoride glasses were studied, but results in fiber drawing were negative. Author (ESA)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-17857 California Univ., Berkeley.
VARIATIONAL METHOD FOR ELECTROMAGNETIC WAVES IN A MAGNETO-PLASMA Ph.D. Thesis
Rene Rafael Dominguez 1979 129 p
Avail: Univ. Microfilms Order No. 8003326

A variational method is presented to derive the electromagnetic response for waves, of an arbitrary beta model plasma, in a magnetic field whose curvature is simulated by an external gravitational field. The variational method, applied in the present work to slab and cylindrical plasma models, obtains the Maxwell integral equations in Fourier space. The limitations of the frequently employed local approximation are established from the approximate differential equations and a symmetric set of local Maxwell equations are obtained which, neglecting Landau resonances, are manifestly Hermitian for real eigenfrequencies. The local Maxwell equations are used to perform a detailed stability analysis of the low frequency drift Alfven mode and the hot electron flute interchange mode. Dissert. Abstr.

N80-17858# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
NONLINEAR PERTURBATIONS OF COLD MAGNETIZED PLASMA GENERATED BY RADIATION PRESSURE FORCES
R. Klima Oct. 1978 16 p refs
(IPPCZ-225) Avail: NTIS HC A02/MF A01

The nonlinear perturbations of plasma density and velocity are derived for the case of a quasi monochromatic wave packet propagating perpendicularly to a magnetostatic field. Radiation pressure forces arising from the time dependence of the wave amplitude are included. Thermal pressure and collisional effects are neglected. The basic equations and assumptions are formulated and the time averaged electric current density is established. The plasma motion in the direction of wave propagation is studied for two particular cases and the results obtained are discussed. A.W.H.

N80-17859# Institute of Plasma Physics, Prague (Czechoslovakia).
THE DISSIPATIVE INSTABILITY OF A RELATIVISTIC ELECTRON BEAM
P. Krocek Sep. 1978 15 p refs
(IPPCZ-224) Avail: NTIS HC A02/MF A01

The theory of the wall instabilities of surface waves excited by an electron beam is developed. Their classification, linear, quasilinear and nonlinear theory is given. It is shown that dissipative instabilities convert practically all the energy lost by the beam into the heating of the lossy walls confining the beam. Author

N80-17860# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
CORPUSCULAR DIAGNOSTICS OF A HOLLOW CATHODE DISCHARGE
J. Rybnicek Sep. 1978 56 p refs
(IPPCZ-223) Avail: NTIS HC A04/MF A01

The intrinsic feasibility of measuring the positive ion mass spectrum of an external magnetic field-free double cathode discharge at pressures up to 130 Pa is demonstrated. A corpuscular diagnostic method for a hollow cathode discharge is described and the experimental results are presented. At the discharge pressure of 10 Pa of argon gas, the energy spectrum of the ions being extracted through a capillary opening shows a marked anisotropy. The mass spectral measurements yield results differing by two orders of magnitude from the expected ones. The concept of limit angle of inelastic scattering is introduced and discussed in terms of classical mechanics. The limit angle is derived on the basis of the energy and momentum conservation laws, holding the inelastic scattering for the limit case of the centra-field motion. The term collision of two absolutely rigid spheres is defined. A.R.H.

N80-17861# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
AN INTEGRAL APPROACH OF SUCCESSIVE COLLISIONS TO LINEAR CHARGED-PARTICLE TRANSPORT THROUGH A FINITE SLAB
S. Kuhn 1979 30 p refs Presented at the Meeting on Math. Methods in Plasma Phys., Oberwolfach, West Ger., 16-21 Sep. 1979 Submitted for publication; sponsored by Fonszue Foerderung der Wissenschaft lichen Forschung, Austria
Avail: NTIS HC A03/MF A01

The steady-state velocity distribution functions of test particles passing through a one-dimensional slab filled with a background gas were calculated. The test particles are injected at a constant rate and accelerated by an applied electric field, at the same time undergoing binary collisions with the background particles. With the assumption of a finite-range (or cut-off) interaction potential, the test particles are classified according to their scattering order, i.e., the number of collisions they have suffered since entering the slab. The related partial distribution functions can be obtained successively by integration of linear, first-order ordinary differential equations along the characteristics. Their sum is the distribution function looked for, which satisfies the linear Boltzmann equation. The Method can quite naturally handle both boundary conditions and strongly non-equilibrium situations, and is amenable to various generalizations. As an example of application, the thermalization of a beam undergoing symmetic charges transfer is given, and the complete analytical solution obtained covers a previous result as a special case. A.R.H.

N80-17862# Avco-Everett Research Lab., Mass.

INVESTIGATION OF THE PRODUCTION OF HIGH DENSITY UNIFORM PLASMAS Final Report, 2 Apr. 1978 - 2 Apr. 1979

D. H. Douglas-Hamilton and P. Rostler May 1979 47 p refs
(Contract F33615-78-C-2013; AF Proj. 2308)
(AD-A076492; AFAPL-TR-79-2059-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 20/9

The discharge streamer instability, which leads to arcing in nonself-sustaining discharges is investigated experimentally and theoretically. Framing camera studies of streamer growth from the cathode of an e-beam sustained discharge in various gases under various discharge conditions are described, analyzed, and compared with theoretical predictions. A previously developed model of the streamer is extended to include a more detailed description of the density, temperature, and input power distributions around the streamer tip. Stable high-density plasma discharges have many applications in plasma physics. An especially significant example is the use of these discharges in high-power gas lasers. The work described here concerns investigation of the external ionization e-beam sustainer method of producing a high-density discharge, together with the advantages and instabilities peculiar to that system. GRA

N80-17863# Westinghouse Electric Corp., Pittsburgh, Pa. Fusion Power Systems Dept.

DESIGN STUDY OF A FUSION-DRIVEN TOKAMAK HYBRID REACTOR FOR FISSILE FUEL PRODUCTION, VOLUME 1 Final Report

R. P. Rose May 1979 284 p refs
(EPRI-ER-1083-Vol-1) Avail: NTIS HC A13/MF A01

Conceptual approaches for a Tokamak fusion driven fuel producing reactor were evaluated. The conceptual design of the hybrid reactor was based on using projected state of the art technology for the late 1980s. The conceptual definitions of two alternatives for the fusion driver were assessed. A two component Tokamak (TCT) concept, based on the TFTR plasma physics parameters, was compared to a beam driven thermonuclear (BDTN) concept, based on the USSR T-20 plasma physics parameters. DOE

N80-17864# Westinghouse Electric Corp., Pittsburgh, Pa. Fusion Power Systems Dept.

DESIGN STUDY OF A FUSION-DRIVEN TOKAMAK HYBRID REACTOR FOR FISSILE FUEL PRODUCTION, VOLUME 2 Final Report

R. P. Rose May 1979 268 p refs
(EPRI-NP-1083-Vol-2) Avail: NTIS HC A12/MF A01

Conceptual approaches for a Tokamak fusion driven fuel producing reactor are discussed. The conceptual design of the hybrid reactor was based on using projected state of-the art technology for the late 1980s. Considerations such as reactor materials and safety are included. The conceptual definitions of two alternatives for the fusion driver were evaluated. A two component Tokamak (TCT) concept, based on the TFTR plasma physics parameters, was compared to a beam driven thermonuclear (BDTN) concept, based on the USSR T-20 plasma physics parameters. DOE

N80-17865# Toulouse Univ. (France). Lab. de Genie Electrique.

PHYSICAL ASPECTS OF POLYMER SURFACE TREATMENT [ASPECTS PHYSIQUES DU TRAITEMENT DES SURFACES POLYMERIQUES]

C. Mayoux 22 Feb. 1978 47 p refs In FRENCH Presented at ADERP Seminar sur [illegible] Chem. des Plasmas et des Appl. Ind., 22 Feb. 1978
(Publ-358) Avail: NTIS HC A03/MF A01

The transformation of polymer surfaces by electric discharges is examined. Industrial processes, laboratory techniques, and measuring procedures are reviewed. An experimental device for polymer treatment in a uniform electric field and two measuring systems for electrical characterization are described. The rates of chemical change on the polymer surface produced by ionized gases and electrons are discussed. The application of plasma treatment to manufacturing light reflectors and electrets as well as textile fiber modifications are analyzed. It is concluded that the existent analytic methods, such as infrared spectrometry, are not yet sufficiently accurate to measure surface modifications and that the reaction mechanisms vary with the polymer constitution. Author (ESA)

N80-17866# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.

PLASMA IN LABORATORY AND SPACE

Hannes Alfven Jul. 1979 54 p refs Presented at 14th Intern. Conf. on Phenomena in Ionized Gases, Grenoble, France, 9-13 Jul. 1979 Submitted for publication
(TRITA-EPP-79-12) Avail: NTIS HC A04/MF A01

The use of scaling laws in the transfer of knowledge concerning laboratory, magnetospheric, and astrophysical plasma phenomena is discussed. The impact of in situ magnetospheric plasma measurements on plasma physics is reviewed. Two kinds of plasma are defined: passive plasma regions described by classical hydrodynamic theory, and active plasma regions, whose structure is considered in terms of boundary conditions and circuit theory. An astrophysical description of the formation of the solar system is presented. Author (ESA)

N80-17867# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.

LONGITUDINAL INVARIANT SURFACES IN RING-CURRENT CONFIGURATIONS Research and Training Program On Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE)

J. Scheffel Apr. 1979 24 p refs
(TRITA-PFU-79-07) Avail: NTIS HC A02/MF A01

The influence of magnetically shielded supports on particle motion in ring current fusion devices was investigated. For this purpose the longitudinal adiabatic invariant was studied. The obtained results confirm earlier approximate deductions of the surfaces generated by the particle drift motion across the magnetic field. It is shown that the disturbances of these surfaces by the support field can be kept small by a proper choice of the system parameters. Author (ESA)

N80-17868# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.

ON PLASMA STABILIZATION IN PRESENCE OF AN INHOMOGENEOUS MAGNETIC VACUUM FIELD Research and Training Program on Controlled Thermonuclear Fusion and Plasma Physics (EUR-NE)

Bo Lehnert Jul. 1979 29 p refs
(TRITA-PFU-79-08) Avail: NTIS HC A03/MF A01

The problem of plasma stability in the presence of an immersed inhomogeneous magnetic vacuum field is examined in terms of the energy principle of magnetohydrodynamic disturbances. Physically relevant boundary conditions are discussed including those which exclude electric surface currents and take realistic current and pressure profiles into account. Two types of configurations are discussed in connection with electromagnetic mode stabilization by means of an inhomogeneous vacuum field. The low beta case of closed vacuum field geometry, and the high beta case of open vacuum field geometry (such as in Extrap configurations with a pinch being immersed in a strongly inhomogeneous transverse vacuum field), are examined. The latter condition replaces that of the Kruskal-Shafranov limit and predicts that stabilization is possible for long wave length kinks in Extrap geometry. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N80-17869 Wisconsin Univ. - Madison.

LOW-FREQUENCY DYNAMICS IN COOPERATIVE JAHN-TELLER SYSTEMS Ph.D. Thesis

Kok Ming Leung 1979 108 p
Avail: Univ. Microfilms Order No. 7927186

Jahn-Teller crystals, the coupled phonon-pseudospin model of the ferroelectric KDP, one dimensional conductor, and the Dicke model of superradiance which are all characterized by

linear couplings between bosons and other dynamic variables are explored. A number of exact results are derived. With the help of these exact results, the low frequency dynamics in strain-induced Jahn-Teller systems are determined. The approach makes use of the general formulism developed recently for the low frequency dynamics of rare earth magnets with degenerate crystal field levels. Detailed studies of the dynamics in the slow and fast relaxation regime are made. As an application of the theory, the ultrasonic attenuation and electrical resistivity of TmZn are examined. Finally, the ultrasonic data in the alpha-phase of the superionic conductor, RbAg4I5, where a Jahn-Teller-like interaction has been proposed, are presented.
Dissert. Abstr.

N80-17870 Case Western Reserve Univ., Cleveland, Ohio.
SECONDARY ELECTRON EMISSION FROM ALUMINUM ALLOY SURFACES Ph.D. Thesis
Richard Ernest Chase 1979 98 p
Avail: Univ. Microfilms Order No. 8001452

Secondary electron emission characteristics were determined for three aluminum alloys with two different surface compositions (natural oxide and chromate conversion layer). Except for a Rutherford backscattering study of one sample, all measurements were made in an ultrahigh vacuum system designed for Auger electron spectroscopy (AES) and equipped with a retarding grid, double pass cylindrical mirror analyzer (CMA). Modifications to the commercial AES electronics package and redesign of the sample carousel allowed three types of measurements to be made with the sample in front of the CMA: (1) Secondary electron energy distribution, (2) secondary electron emission coefficent, and (3) surface composition by AES. Dissert. Abstr.

N80-17871 California Univ., Berkeley.
INFRARED ABSORPTION SPECTROSCOPY OF CARBON MONOXIDE ON NICKEL FILMS: A LOW TEMPERATURE THERMAL DETECTION TECHNIQUE Ph.D. Thesis
Robert Brian Bailey 1979 134 p
Avail: Univ. Microfilms Order No. 8000276

Sensitive vibrational spectra of carbon monoxide molecules adsorbed on evaporated nickel films were measured by attaching a thermometer to the sample, cooling the assembly to liquid helium temperatures, and recording the temperature changes which occur when infrared radiation is absorbed. The measurements are made in an ultrahigh vacuum chamber in which the sample surface is cleaned, heated, exposed to gas molecules, and cooled to 1.6 K. The spectra of chemisorbed CO molecules are interpreted in terms of the linear and bridge absorption sites on the nickel surface. The spectra also shows how the distribution of molecules among these sites changes when the CO coverage increases and intermolecular forces become important. The spectra of physically adsorbed molecules in both monolayer and multilayer films are reported. Dissert. Abstr.

N80-17872 Stanford Univ., Calif.
PART 1: ENERGY BARRIER FOR ELECTRON PENETRATION INTO NOBLE LIQUIDS. PART 2: DIELECTRIC PROPERTIES OF SUPERFLUID HELIUM-THREE Ph.D. Thesis
Lawrence Lane Tankersley 1979 145 p
Avail: Univ. Microfilms Order No. 8002023

The Galitskii approach is used to calculate the self energies in order to find the energy barrier opposing the penetration of electrons into liquid helium, neon, and argon. The energy is computed to second order in the s wave scattering length using the liquid structure factor to describe the actual two body correlations in the host liquid. Dielectric screening corrections to the electron-atom interaction are included for the cases of neon and argon. The predictions for the dielectric behavior of superfluid helium three A are reviewed. A molecular model is proposed to improve the description of the interaction between two polarized helium atoms. Dissert. Abstr.

N80-17873 Brandeis Univ., Waltham, Mass.
BRILLOUIN AND RAMAN SCATTERING STUDIES OF SrTiO3 NEAR THE PHASE TRANSITION TEMPERATURE Ph.D. Thesis
Chin-Bing Su 1979 139 p
Avail: Univ. Microfilms Order No. 7925729

A single mode argon ion laser was used to study the Brillouin modes and the soft optic Raman modes near the 107 K structural phase transition in a stressed single domain crystal of SrTiO3. The direction acoustic phonon wave vector q was examined. All three Brillouin modes were studied under the same cool down run with reproducible results and the Brillouin spectra were analyzed with a triple pass plane Fabry-Perot interferometer. The soft Raman spectra were analyzed with a grating spectrometer.
Dissert. Abstr.

N80-17874# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
GIANT MAGNETISM IN PRESSURE QUENCHED CADMIUM SULFIDE
R. K. MacCrone and C. G. Homan Sep. 1979 17 p refs
(DA Proj. 1L1-161102-H-60)
(AD-A076171; AD-E440049; ARLCB-TR-79023) Avail: NTIS HC A02/MF A01 CSCL 20/3

Large positive magnetism (paramagnetism) is reported in poly-crystalline CdS samples pressure quenched from above the semiconducting-conducting phase transition. This positive magnetism reaches a maximum magnetization approaching four gauss at fields between five and twelve KOe. GRA

N80-17875# Pennsylvania State Univ., University Park. Materials Research Lab.
MAGNETOFERROELECTRICS, DIVERTABLE FERROELECTRICS AND PYROELECTRIC GLASS CERAMICS Final Report, 22 Mar. 1976 - 21 Jun. 1979
R. E. Newnham, L. E. Cross, W. A. Schulze, and A. S. Bhalla 21 Jun. 1979 66 p refs
(Contract DAAG29-76-G-0145; DA Proj. 1T1-61102-BH-57)
(AD-A076202; ARO-13731.4-P) Avail: NTIS HC A04/MF A01 CSCL 20/3

The highlight of the past three years was the discovery of magnetoferroelectricity, a new type of ferroelectricity caused by the ordering of magnetic spins in a low symmetry arrangement. A magnetoferroelectric develops a reversible spontaneous electric polarization on passing through a magnetic phase transition. The effect was demonstrated on Cr2BeO4 which undergoes a phase transformation from a centric paramagnetic state to a complex antiferromagnetic state at 28K. Ceramic specimens can be poled electrically below the transition temperature to a remnant polarization about five orders of magnitude smaller than BaTiO3. Additional magnetoferroelectric studies have been carried out on single crystals of CrBeO4 and on certain mixed crystals in the Fe2O3-Cr2O3 system. Second harmonic signals were observed from PbZrO3 ceramics, verifying the acentric nature of this important end member of the PZT system. Divertable ferroelectrics are an interesting group of materials in which the spontaneous polarization can be reoriented, but not reversed. The results of some experiments on nickel iodine boracite, and on barium titanium germanate are described. A new class of pyroelectric materials is reported. Carefully crystallized lithium silicate glass-ceramics are found to be pyroelectric. GRA

N80-17876# Missouri Univ. -Kansas City. Dept. of Physics.
MOLECULAR AND CRYSTALLINE ELECTROMAGNETIC PROPERTIES OF SELECTED CONDENSED MATERIALS IN THE INFRARED Final Report, 1 Apr. 1976 - 30 Jun. 1979
Marvin R. Querry 30 Aug. 1979 266 p refs
(Contract DAAG29-76-G-0185; DA Proj. 1T1-61102-BH-57)
(AD-A076502; ARO-13739.9-GSX) Avail: NTIS HC A12/MF A01 CSCL 20/8

By using water as a reflectance standard, relative specular reflectance spectra in the infrared were measured for 38 materials including aqueous solutions of zinc chloride, phosphoric acid, and nitric acid, and for diesel fuel, fog oil, tetramethyl-tetraphenyl-trisiloxane, l-hexadecanol, l-octadecanol, l-eicosanol, rutile, lucite, limestone, and natural waters. Spectral values of the complex refractive indices, suitable for Mie scattering computations, were computed and tabulated by use of Kramers-Kronig analysis. The spectra were further analyzed in terms of fundamental intra and inter-molecular vibrational modes. Transmittance spectra of powders pressed in a KBr matrix were also measured. Powders were montmorillonite, colemanite, Kernite, Kaolin, Lampblack, activated charcoal, and wood charcoal. Analysis of the transmittance spectra was not completed but is still underway during continuation of this research. Tabulations of all complex refractive indices were supplied to the Aerosol/Obscuration Science Group at the Aberdeen Proving Ground, Md. GRA

N80-17877# Aerospace Corp., El Segundo, Calif.
FABRICATION AND ELECTRICAL PROPERTIES OF EPITAXIAL PbTe METAL-INSULATOR-SEMICONDUCTOR STRUCTURES Interim Report
P. H. Zimmermann, M. E. Mathews, and D. C. Joslin 30 Aug. 1979 24 p refs
(Contract F04701-78-C-0079)
(AD-A075776; TR-0079-4970-20-1; SAMSO-TR-79-92) Avail: NTIS HC A02/MF A01 CSCL 09/1

Methods for the fabrication of metal insulator semiconductor structures with the use of epitaxial PbTe films are described. These methods obviate the need for treating the semiconductor surface. They involve epitaxial film growth in a vacuum environment by hot-wall epitaxy followed by (1) deposition of ZrO2 without breaking vacuum and (2) deposition of pyrolytic SiO2. Capacitance-voltage characteristics in both cases closely correspond to theoretical values. Depletion layer generation is shown to be the dominant contribution to the inversion conductance. GRA

N80-17878# Aerospace Corp., El Segundo, Calif. Electronic Research Lab.
JOSEPHSON JUNCTION CHARACTERIZATION FROM IMPEDANCE MEASUREMENTS Interim Report
Helmut Kanter 14 Sep. 1979 27 p Supersedes ATM-78(3727)-1
(Contract F04701-78-C-0079)
(AD-A075216; TR-0079(4727)-1; ATM-78(3727)-1; SAMSO-TR-79-54) Avail: NTIS HC A03/MF A01 CSCL 20/12

Voltage biased junctions in SQUID type configurations show a characteristic response in their MW impedance, which as indicated by a small signal analysis appears primarily determined by the junction termination at the low frequency idler. The evaluation of the response affords the measurement of some circuit and junction parameters which cannot otherwise be obtained from I-V measurements and thus could be considerable help in characterizing Josephson junctions in microwave circuits. GRA

N80-17879# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
GaAs MONOLITHIC MICROWAVE SUBSYSTEM TECHNOLOGY BASE
J. Oakes and D. W. Maki Jun. 1979 61 p refs
(Contract N00014-78-C-0268; DARPA Order 3543)
(AD-A075287; Rept-78-0841) Avail: NTIS HC A04/MF A01 CSCL 20/12

In the materials area, effort on this program during the first six months has been devoted to process technology development, and materials study and qualification. Equipment delays and malfunctions have limited progress however, direct implants and implants into both VPE and LPE were investigated with encouraging results. Investigation of self aligned gate FET's have shown high gate resistance and feedback capacitance, and corresponding low grain, resulting in a decision to revert to realized gate FET's. Interdigital capacitors with values up to 2 pf have been fabricated for use as tuning capacitors. A one bit phase shifter has been designed using lumped elements and Schottky barrier chip diodes. Testing was delayed, however, by a mask error which is being corrected. GRA

N80-17880# Honeywell Corporate Technology Center, Bloomington, Minn.
GROWTH OF SINGLE CRYSTAL GALLIUM PHOSPHIDE BY LIQUID PHASE EPITAXY AND SYNTHESIS SOLUTE DIFFUSION Final Technical Report, 1 Apr. 1977 - 30 Sep. 1978
P. E. Petersen, R. G. Schulze, and S. R. Peterson Apr. 1979 121 p refs
(Contract F33615-77-C-5043; AF Proj. 2423)
(AD-A075065; HR-47108; AFML-TR-79-4049) Avail: NTIS HC A06/MF A01 CSCL 20/2

The objective of this research program was to further develop the synthesis-solute-diffusion (SSD) and liquid-phase epitaxy (LPE) techniques for the growth of high-quality gallium phosphide. This program resulted in the growth of epitaxial layers of GaP which had excellent growth morphology and carrier concentrations approximately 3 over 5 x 10 to the 15 power. The SSD technique was advanced so that low dislocation density bulk GaP could be grown. Carbon was identified as the principal acceptor in this material which limited the carrier concentration to approximately 3 over 2 x 10 the 16 power. An extensive materials evaluation program was conducted as a part of this development. The morphology of the grown material was analyzed by optical and electron-microscopic techniques. Hall and resistivity analysis was used to determine the majority carrier transport properties. The carrier concentration profiles were determined by capacitance-voltage measurements. The deep levels were investigated by photocapacitance spectroscopy, and the minority carrier diffusion lengths were measured by the Schottky-barrier photo current technique. GRA

N80-17881# Stanford Univ., Calif. Center for Materials Research.
PREPARATION AND CHARACTERIZATION OF SINGLE CRYSTALS AND EPITAXIAL LAYERS OF SILICON CARBIDE BY MOLTEN SALT ELECTROLYSIS Annual Report, 15 Jul. 1978 - 14 Jul. 1979
T. H. Geballe, R. S. Feigelson, and D. Elwell Oct. 1979 29 p refs
(Contract N00014-78-C-0489; RR0210203)
(AD-A076281; CMR-243-026-001) Avail: NTIS HC A03/MF A01 CSCL 20/2

The synthesis of silicon carbide by electrolysis of molten salts has been achieved for the first time. Two systems have been investigated, one involving K2SI F6 and LI2 CO3 Dissolved in a KF/LI F eutectic, the other being a combination of NA2 CO3 and Si O2 with Na BO3 and Li F. The latter system has given much more reproducible results. In both cases, electrolysis has proceeded at about 750 C which is very low in comparison with the melting point of silicon carbide. Synthesis of Si C at temperatures below 1000 C does not appear to have been previously reported. Possibly because of the low deposition temperature, it has been found necessary to use deposition potentials which are appreciably highter than the minimum value. This use of relatively high deposition potentials and corresponding current densities leads to irregular growth morphology and to deposition of metastable 2 H and 33 R polytypes rather than the stable 6 H or 15 R. The Si C is co-deposited with an excess of amorphous carbon. Changes in melt composition to reduce the carbonate to silicate ratio are necessary to eliminate this excess. Initial deposits are relatively impure, the major contaminants being constituents of the inconel furnace lining. GRA

N80-17882# Naval Research Lab., Washington, D. C.
BROADBAND GaAs MESFET POWER AMPLIFIER DESIGN ASPECTS Final Report
H. A. Willing and W. H. Ku Oct. 1979 50 p refs
(AD-A075692; NRL-8334) Avail: NTIS HC A03/MF A01 CSCL 09/5

This report presents design aspects of ultra-wideband Ga As MESFET power amplifiers which are directed to ECM and EW system applications. Fundamental gain-bandwidth limitations are derived for state-of-the-art Ga As MESFET power devices. Broadband designs are developed in the 2- to 18- GHz range using analytical and computer-aided optimization techniques. These designs are based upon small-and large-signal device characterization and modeling. Presented are systematic procedures required to arrive at the final designs. Modeling techniques and their utilization as a tool in achieving optimum performance are described. Included in this report is a discussion of the laboratory methods employed to perform small-and large-signal device characterization and analysis. GRA

N80-17883# Edinburgh Univ. (Scotland). Dept. of Physics.
AN INVESTIGATION OF THE DYNAMICAL PROPERTIES OF CRYSTALS BY RAMAN SPECTROSCOPY Final Report, 29 Aug. 1977 - 30 Jun. 1979
W. Taylor Jun. 1979 14 p refs

(Grant DA-ERO-77-G-076)
(AD-A072968) Avail: NTIS HC A02/MF A01 CSCL 20/2

This report describes light scattering measurements from a variety of materials which undergo structural phase transitions. The materials studied include boracites, lead germanate and perovskites and the studies have found new transitions, determined the nature of the soft mode and detailed the changes in the spectra due to the presence or addition of impurities. In addition associated theoretical work has questioned the validity of the usual way of interpreting soft mode results obtained from light scattering techniques. An experiment was also performed to study the light scattering from magnons in a mixed antiferromagnet.
GRA

N80-17884# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.

ANNEALING OF ION-IMPLANTED SILICON BY AN INCOHERENT LIGHT PULSE

H. A. Bomke, H. L. Berkowitz, M. Harmatz, S. Kronenberg, and R. Lux Jul. 1979 8 p refs Repr. from Appl. Phys. Lett., v. 33, no. 11, 1 Dec. 1978 p 955-957
(DA Proj. 1L1-61101-A-91A)
(AD-A073495; DELET-TR-79-18) Avail: NTIS HC A02/MF A01 CSCL 20/12

Annealing of boron-implanted silicon by a single 15-microsecond pulse from a flash lamp has been observed. The required energy density was 27 joules per square centimeter incident on the silicon. Electrical activity of boron was comparable to that in thermally annealed samples. GRA

N80-17885# Brookhaven National Lab., Upton, N. Y.

INTERACTION BETWEEN ELECTRONS AND TUNNELING LEVELS IN METALLIC GLASSES

J. L. Black and B. L. Gyorffy 1978 5 p refs Presented at 15th Conf. on Low Temperature Phys., Grenoble, France, 23 Aug. 1978
(Contract EY-76-C-02-0016)
(BNL-24235; CONF-780824) Avail: NTIS HC A02/MF A01

A simple model in which the conduction electrons of a metallic glass experience a local time-dependent potential due to two-level tunneling states is considered. The model exhibits interesting divergent behavior which is quite different from that predicted by an earlier s-d Kondo model. DOE

N80-17886# Rochester Univ., N. Y.

GROUND STATE PROPERTIES AND ENERGY PARAMETERS OF THE ANDERSON LATTICE SYSTEM, CeAl2

R. D. Parks, L. C. Kupferberg, M. C. Croft (Rutgers - The State Univ., Piscataway, N. J.), S. M. Shapiro (BNL), and E. Gurewitz (BNL) 1978 7 p refs Presented at Colloq. of Phys. of the Metallic Rare Earths, St. Pierre de Chartreuse, France, 4 Sep. 1978
(Contract EY-76-C-02-0016)
(BNL-24655; CONF-780913-3) Avail: NTIS HC A02/MF A01

Results of magnetostriction and thermal expansion measurements on CeA12 in and near the antiferromagnetic (AF) phase are summarized. Preliminary results of an ongoing neutron scattering study are also included. The AF phase boundary in the H-T plane, the nature of the reorientation of the AF domains in field, and the evolution of the AF order parameter in field are among the topics covered. The nature of the AF fluctuations above T sub N and the magnetic exchange between Ce atoms are also discussed. J.M.S.

N80-17887# National Physical Lab., Teddington (England). Div. of Electrical Science.

PRELIMINARY EXPERIMENTS ON THE FEASIBILITY OF FABRICATING STABLE JOSEPHSON POINT CONTACTS FOR SUBMILLIMETER-WAVELENGTH RECEIVERS

T. G. Blaney and N. R. Cross Apr. 1979 89 p refs
(NPL-SI-89/0414; ESA-CR(P)-1235) Avail: NTIS HC A05/MF A01

The feasibility of constructing point contacts which are mechanically and electrically stable was investigated in the context of conditions of repeated temperature cycles between 300K and liquid He temperature, and quality and geometry compatible with use at submillimetric wavelengths. The experiments were concentrated on one form of device consisting of a contact between two niobium wires (130 micrometers diameter) which is sealed into, and supported by a glass tube encapsulation. The dc characteristics of the devices were monitored at both test temperatures. The laser-sealed devices are sufficiently promising to warrant further development. The best of the tested devices could be repeatedly cycled without change in electrical or mechanical characteristics. The tests show that the remaining quality problems can probably be solved by sealing the devices in vacuum. Author (ESA)

N80-17888# Loughborough Univ. of Technology (England). Dept. of Mathematics.

THE DEVELOPMENT OF A GENERAL SURFACE UNDER ION BOMBARDMENT

R. Smith Sep. 1978 21 p refs
(Maths-Res-130) Avail: NTIS HC A02/MF A01

The numerical calculations used to determine the development of surface topography during ion beam sputtering are presented. The theory is applied both to a three dimensional example and to an example illustrating the effects of a nonuniform ion beam. Results for the surface erosion of an elliptical hummock indicate the development of an edge along the top of the hummock parallel to the major axis of the ellipse which develops into a more pointed structure. The effect of a Gaussian beam, is depicted graphically and shows that for a wide beam, a circle erodes into a wedge like structure. Author (ESA)

N80-17889# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).

STUDY OF THE FORMATION PROCESS FOR COMPOUND AGGREGATES: APPLICATION TO IONIZED CLUSTER BEAM DEPOSITION OF GaAs THIN FILMS Final Report [ETUDE DU PROCESSUS DE FORMATION D'AGREGATS DE COMPOSES APPLICATION AU DEPOT EN COUCHES MINCES DE GaAs L'AIDE D'UN FAISCEAU D'AGREGATS CHARGES]

A. Mircea-Roussel Jul. 1979 22 p refs In FRENCH; ENGLISH summary
(Contract DGRST-78-7-0315)
(LEP-79/538.SME-651-B) Avail: NTIS HC A02/MF A01

The ionized cluster beam deposition technique was used in growing layers of the 3-5 compound InAs. Two separate sources for the elements and a mixing chamber were used. Results show that InAs layers are obtained only under very restrictive conditions. Author (ESA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-17890 Stanford Univ., Calif.

RAYLEIGH-BENARD CONVECTION FROM THERMODYNAMIC FLUCTUATIONS Ph.D. Thesis

Bharat S. Jhaveri 1979 76 p
Avail: Univ. Microfilms Order No. 8001943

The evolution of cellular convection from disturbances present in an initially conducting but potentially unstable fluid system is studied. A weakly supercritical transient Rayleigh-Benard problem is considered. The random initial value problem is formulated by deriving the system of Ito-stochastic differential equations for the random Fourier amplitudes of evolving disturbances, and specifying the statics of the random forcing and initial values. An approximate ensemble for the random evolution is constructed by Monte Carlo simulation. The influence of random forcing during different stages of evolution is examined. Time dependent moment properties of interest generated from the approximate ensemble are discussed and the onset time for instability is evaluated. Highly supercritical conditions are investigated. Dissert. Abstr.

N80-17891 California Univ., Berkeley.
A COMPARISON OF SYSTEM PARAMETER IDENTIFICATION METHODS AS APPLIED TO A PARTICULAR THERMAL DYNAMICS PROBLEM Ph.D. Thesis
Peter VanBlarigan 1979 135 p
Avail: Univ. Microfilms Order No. 8000254

A method of cooling the detonators to -54 C in minimum time, with assurance that the temperatures are uniform and accurate is described. A mathematical system model was used to predict minimum cooling time. Due to the complexity of the detonator, the model was predicted using a system identification approach. Five identification methods were tested and evaluated. The five methods were least squares, stochastic approximation, sequential learning, model reference adaptive system, and heuristic identification. The system to be identified was assumed to be an eighth order discrete linear system. A state space configuration was used, and each state variable, or temperature, was measured to obtain the system output for identification. The Stochastic Approximation and Sequential Learning methods were found to work the best. Dissert. Abstr.

N80-17892# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
SUPERCOOLED AND SUPERHEATED WATER
C. A. Angell Oct. 1979 40 p refs
(Contract N00014-78-C-0035)
(AD-A076152) Avail: NTIS HC A03/MF A01

Various thermodynamic, transport and structural features of water in its metastable states, both supercooled and superheated, have been determined in recent years, and highly anomalous behavior has been found near the limiting temperatures in each case. For example, the heat capacities increase exponentially at each extreme. In the high temperature extreme this behavior is predictable from van der Waals theory, but the low temperature anomaly is not. The measurements will be reviewed, with emphasis on the more extensively studied supercooled states at normal and high pressure, and evidence will be given that the low temperature anomalies can be described by expressions containing a singular temperature closely associated with the temperature of homogeneous nucleation of ice I. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-17893 Stanford Univ., Calif.
COMPUTATIONAL ISSUES IN LINEAR LEAST SQUARES ESTIMATION AND CONTROL Ph.D. Thesis
John Anthony Newkirk 1979 250 p
Avail: Univ. Microfilms Order No. 8001980

Various approaches to solving the matrix Riccati equation are examined. Scattering theory is used to provide a pure derivation of several square root algorithms. A set of criteria for choosing among these algorithms is presented and examined with empirical evaluations. Differentiating criteria include sensitivity to repeated closed-loop eigenvalues, the impact of singular model parameters, computational accuracy, and the rate of convergence. Sensitivity to parameter uncertainty in discrete-time systems is considered using a quadratic minimization of a generalized cost function. This same algorithm is used to design arbitrary-order compensation using complete system information. For discrete-time systems, the square root doubling algorithms are found to be comparable to the eigenvector decomposition algorithms in terms of memory requirements, elapsed computation time, and performance. The doubling algorithms are also found to solve a wider class of problems. Dissert. Abstr.

N80-17894 Stanford Univ., Calif.
CRISIS DECISION ANALYSIS Ph.D. Thesis
Burke Edward Robinson 1979 118 p
Avail: Univ. Microfilms Order No. 8001999

A modeling procedure, adapted from standard decision analysis methods, that guides the structuring, assessment, and analysis of crisis decisions. Features of the crisis modeling procedure include: (1) identify and structure all those, and only those, variables that may change the decision; (2) assess probable outcomes quickly and efficiency; and (3) indicate, at any moment, the best decision and the value of further modeling. Concepts and associated techniques for constructing a skeleton model are suggested and described including template, sequence, influence, tree, preference, and inquiry. Outcome assessments are made only after the procedure indicates that a new alternative or event should be added to the model and are assessed as estimates rangine from the worst probable to the best probable outcomes. The procedure is used to model the Mayaguez crisis of 1975 and a proposed corporate crisis concerning the purchase of ore. Dissert. Abstr.

N80-17895 Stanford Univ., Calif.
THE CONCEPT OF INFLUENCE AND ITS USE IN STRUCTURING COMPLEX DECISION PROBLEMS Ph.D. Thesis
Daniel Lee Owen 1979 140 p
Avail: Univ. Microfilms Order No. 8001983

A general mathematical characterization of the influence between random variables in a decision problem is described. The definition of influence can serve the decision analyst by helping him to conceptualize and communicate the relationship of the probability distributions on different variables in a probabilistic decision model. The definition of influence supports a calculus of influences that allows one to compute the total influence of one variable on another even when there are several intermediate variables. Using this influence calculus, the importance of a particular variable to the decision model can be determined. An immediate consequence is a recommendation for which variables to include in the model and whether the uncertainty about a variable is important. The theoretical bases of the influence method and conventional discretization are compared. Dissert. Abstr.

N80-17896 California Univ., Berkeley.
INTERVAL ELIMINATION METHODS FOR INTERACTIVE OPTIMIZATION OF MULTIPLE OBJECTIVES Ph.D. Thesis
Anthony Neal Payne 1979 151 p
Avail: Univ. Microfilms Order No. 8000476

The tradeoff problem arising when multiple, conflicting objectives must be optimized is considered and a man machine interaction methodology by which the decision-maker can efficiently and accurately estimate his preferred objective value from the tradeoff set is developed. A model of a special class of decision-makers for which an inverval representation defines an interval of uncertanity containing the preferred objective value is proposed. A measure of worst-case uncertainty is formulated as a criterion for optimal strategies and the bi-objective tradeoff problem is studied in detail. The worst-case uncertainty is minimized to derive optimal strategies. These stragies are then used to develop a general algorithm. Finally, the general multi-objective tradeoff problem is considered. An efficient strategy for placing experiments is proposed and used to devise a general interval elimination method in algorithmic form. Dissert. Abstr.

N80-17897# RAND Corp., Santa Monica, Calif.
BUNCHED LAUNCH, BUNCHED ACQUISITION, AND WORK-AROUNDS-ELEMENTS OF ALTERNATIVE SPACECRAFT ACQUISITION POLICIES Interim Report
B. W. Augenstein, David Dreyfuss, and Anson G. Parish Oct. 1979 74 p
(Contract F49620-77-C-0023)
(AD-A076490; RAND/R-2166-AF) Avail: NTIS HC A04/MF A01 CSCL 22/2

A review of spacecraft acquisition policy to determine whether, and to what degree, variations in acquisition methods can lower total space system costs without loss of operational capability

The authors conclude that there is an alternative to the conventional acquisition strategy; it would involve changes both in the conventional procurement process and in the conventional launch process. This alternative decreases system costs while increasing operational capability, and is equally useful with either an expendable booster or a Space Transportation System recoverable booster used for launch. The concept would call for bunched launch (launching the total mission-required spacecraft in as short a time as possible) and bunched procurement (buying the total number of satellites needed at one time) necessitating accommodations to institutional constraints and the present legal and regulatory framework. GRA

N80-17898# Decision Research Corp., Eugene, Oreg.
BEHAVIORAL ASPECTS OF COST-BENEFIT ANALYSIS
Baruch Fischhoff Jan. 1979 38 p refs
(Contract N00014-79-C-0029; ARPA Order 3668)
(AD-A075099; PTR-1077-79-1) Avail: NTIS
HC A03/MF A01 CSCL 05/10

Characteristic limits of cost benefit analysis techniques are surveyed. These include: (1) the unavailability of necessary inputs to the analysis; (2) the absence of procedures for assessing the validity of an analysis; and (3) the necessary incompleteness of any formal model of a decision situation. The usefulness of cost benefit analysis as a management tool is emphasized. J.M.S.

N80-17899# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. Dept. of Systems Management.
INTERACTIVE PROGRAMMING FOR MANAGEMENT AIDS TO DECISION MAKING: QUEUEING THEORY APPLIED M.S. Thesis
Paul Hamilton Sep. 1979 131 p
(AD-A076982; AFIT/GSM/SM/79S-6) Avail: NTIS
HC A07/MF A01 CSCL 05/10

Quantitative models for decision-making are useful only if they are available to those who must make the decisions. QUEUE1, an interactive computer program which incorporates six basic queueing theory models, was developed. QUEUE1 and instructions were designed for use by mid-level managers who do not have an extensive knowledge of computer operations or modeling theory. QUEUE1 was tested on five individuals. Test results lead to the conclusion that interactive programming techniques can present quantitative models to non-technical managers in a useable format. GRA

N80-17900# General Technology Systems Ltd., London (England).
STUDY AND IMPLEMENTATION OF AN ESA COMPUTERIZED PLANNING SYSTEM. VOLUME 1: PLANNING SYSTEM FUNCTIONS AND STRUCTURE Progress Report
R. Brunt, G. E. Hall, and L. W. Steings Jan. 1978 154 p 3 Vol.
(Contract ESA-3172/77-F-WMT)
(GTS-760972-Vol-1; ESA-CR(P)-1222-Vol-1) Avail: NTIS
HC A08/MF A01

The program structure, system functions, user and data requirements are presented for a computerized system used for planning, decision making, and information retrieval within the European Space Agency. The programs, written in FORTRAN 4, permit analysis of cost data, manipulation of price levels, currencies, cost elements, prediction of national space expenditure capabilities, and the margin available for new projects, as well as the selection of projects relative to the margin, and a comparison of manpower requirements with forecast industrial capacity. Author (ESA)

N80-17901# General Technology Systems Ltd., London (England).
STUDY AND IMPLEMENTATION OF AN ESA COMPUTERIZED PLANNING SYSTEM. VOLUME 3: PROGRAM DOCUMENTATION Progress Report
G. E. Hall, N. R. Craddock, W. Spiess, and P. Thermann Oct. 1978 213 p 3 Vol.
(Contract ESA-3172/77-F-WMT)
(GTS-760972-Vol-3; ESA-CR(P)-1222-Vol-3) Avail: NTIS
HC A10/MF A01

The computer implementation aspects of a computerized planning system for ESA are described. Both the configurations of the programs and of the 15 data files, deduced using some basic roles, are described. The derivation of the program structure is discussed along with the data file derivation. Tables of intrinsic data are presented. Author (ESA)

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see 61 Computer Programming and Software.

N80-17902 California Univ., Berkeley.
SEARCH MECHANISMS FOR LARGE FILES Ph.D. Thesis
Marie-Anne Kamal Neimat 1979 194 p
Avail: Univ. Microfilms Order No. 8000460

Search methods for files that are sorted and sequentially stored on secondary storage are studied. The method of successive linear interpolation (SLI) is analyzed. It is shown that SLI takes on the order of log log N searches to locate a key in the file of N sorted, uniformly distributed keys. The method of SLI is compared to false position and binary search methods. An algorithm which selects (under certain conditions) the optimum partition of data blocks into clusters for tree structured indexes is presented. This algorithm runs in time M(3), where M is the number of blocks in the file. Also presented are nonoptimal, linear time algorithms, which also yield structures giving file access times significantly less than that of the original full tree. The organization and memory management of the index trees for sequential files are considered. Dissert. Abstr.

N80-17903 Indiana Univ., Bloomington.
A MATHEMATICAL MODEL TO EVALUATE THE EFFECTS ON RETRIEVAL TIMES OF ALTERNATE STRUCTURES FOR LIBRARY DATABASE DESIGN Ph.D. Thesis
Karen Andrea Momenee 1979 273 p
Avail: Univ. Microfilms Order No. 8000709

A model is developed to aid in choosing the most efficient data structures for library databases. The model consists of two parts: an information model which can be totally divorced from the machine implementation and enables the designer to describe the contents of the database and query stream in set theoretic terms; and a retrieval model which simulates the operation of the database and measures retrieval time for various structural configurations and query forms in terms of seeks (or access movements) and rotations of the disk. Assumptions in previous models of a uniform distribution of attribute-values are replaced with bibliometric distributions based on author productivity and the frequency of occurrence of words in natural language. These distributions are used to generate the queries and as a statistical sketch to describe the probable contents of the database. Dissert. Abstr.

N80-17904*# National Aeronautics and Space Administration, Washington, D. C.
THE POTENTIALITIES OF SEVERAL DATA PROCESSING SYSTEMS FOR COMPRESSING INFORMATION
Yu. K. Khodarev Feb. 1971 24 p refs Transl. into ENGLISH of "potentsial'nyye jozmozhnosti szhatiya informatsii nekotorykh sistem obrabotki dannykh", Rept. Pr-24 Acad. of Sci. U.S.S.R., Inst. of Space Res., Moscow, 1970 24 p Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-2035)
(NASA-TT-F-13845; Pr-24) Avail: NTIS HC A02/MF A01 CSCL 05B

The data compression coefficient of systems for gathering and processing data from spacecraft is classified. The extremal probability distributions give the values of the maximal and minimal mean coefficient of frame compression for any values of the mean number of active channels in the frame. It is found that the real coefficients of frame compression are close to the minimally possible ones for the obtained values of the mean number of active channels in the frame. Author

N80-17905*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AOIPS DATA RETRIEVAL SYSTEM (DRS) SUPPORT FOR GARP SEA ICE AND RAIN RATE DATA SETS

K. W. Posey Nov. 1978 38 p
(NASA-TM-79686) Avail: NTIS HC A03/MF A01 CSCL 05B

The functional capabilities which are incorporated into the Goddard Space Flight Center Atmospheric and Oceanographic Information Processing System (AOIPS) Data Retrieval System (DRS) are identified. These capabilities provide access to sea ice concentration and ocean rainfall rate data sets produced from the Nimbus-5 and Nimbus-6 Electrically Scanning Microwave Radiometer brightness temperature measurements for the Global Atmospheric Research Program Project during its Data Systems Tests. This support consists of four basic functions: (1) an inventory capability which provides a description of the contents of each tape resident sea ice and rain rate data set; (2) a selective tape to tape copy capability which allows for the creation of a subset data tape containing only those data sets of interest; (3) a data set selection capability whereby the contents of a specific data set can be displayed or printed or transferred to disk for further processing; and (4) an image display capability which allows for specified data sets to be transformed into a digital image format for subsequent display and analysis on the AOIPS image analysis terminals. J.M.S.

N80-17906# Massachusetts Inst. of Tech., Cambridge. Center for Information Systems Research.

THE INTELLIGENT MEMORY SYSTEM ARCHITECTURE RESEARCH DIRECTIONS

Chat-Yu Lam and Stuart E. Madnick Aug. 1979 46 p refs
(Grant N00039-78-G-0160)
(AD-A073485; CISR-M010-7908-01; CISR-TR-1) Avail: NTIS HC A03/MF A01 CSCL 09/2

Information storage, retrieval, communication, and processing have become increasingly important for modern command and control systems. Conventional computers are primarily designed for computational purposes and are not well-suited for information management. This report introduces the concepts and research directions of the Intelligent Memory System (IMS), which is particularly designed for large-scale information management to support future command and control systems. Author (GRA)

N80-17907# Bundesministerium fuer Wissenschaft und Forschung, Vienna (Austria).

AUTOMATED RETRIEVAL OF SCIENTIFIC INFORMATION IN AUSTRIA [DATEN, DIENSTE, DOKUMENTE 3: AUTOMATISIERTE WISSENSCHAFTS- INFORMATIONS-SYSTEME IN OESTERREICH. BESTANDSAUFNAHME]

1978 107 p Partly in ENGLISH and GERMAN
(ISBN-3-7002-0461-2) Avail: NTIS HC A06/MF A01

The problems caused by the increase in scientific publishing and the efforts to ameliorate the situation through the use of computerized retrieval systems are discussed. The equipment and systems available in Austria are surveyed. Prospects for the development of new systems are examined. Author (ESA)

N80-17908# British Library, London (England). Graphic Information Research Unit.

TWO EXPERIMENTS ON THE LAYOUT OF INFORMATION ON COMPUTER OUTPUT MICROFILM. 1: COLUMN SPACING AND HORIZONTAL CODING IN TABLES AND INDEXES. 2: SINGLE VERSUS DOUBLE COLUMN FORMATS FOR CINE AND COMIC MODE LIBRARY CATALOGUES

Linda Reynolds and Herbert Spencer Jan. 1979 66 p
(BLRDR-5480) Avail: British Library Lending Div., Boston Spa, Engl.

The effects of column spacing and horizontal coding on a subject's ability to read across between two columns of information, and the ease of use of single versus double column formats for cine and comic mode library catalogs were investigated in an effort to improve the readability of information on computer output microfilm. Results show that both column spacing and horizontal coding significantly affect the speed with which the task is performed. The use of a line space or a line space with a rule after every fifth entry, or with leader dots between columns is recommended. Column spacing had no effect on the scores obtained. An interaction was found between the complexity and length of the entries and the chosen format in terms of ease of use of the catalog. This interaction affects the spatial relationship between adjacent entries. A.R.H.

N80-17248 Army Engineer Waterways Experiment Station, Vicksburg, Miss.

TECHNICAL INFORMATION RESOURCES FOR THE SHOCK AND VIBRATION COMMUNITY

Edward J. Kolb *In* The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 1 Sep. 1978 p 11-18 (For primary document see N80-17247 08-31)
Avail: NRL Tech. Inform. Div., Washington, D.C.

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N80-17909# Planco, Inc., Dallas, Tex.

SURVEY OF THE RESEARCH INTO ENERGY-ECONOMIC INTERACTIONS. VOLUME 2: ANNOTATED BIBLIOGRAPHY

R. Coates, D. Hanson, S. Tuenger, and J. Kennington Apr. 1979 423 p
(Contract EI-78-C-01-6346)
(DOE/TIC-10134-Vol-2) Avail: NTIS HC A18/MF A01

Abstracts of about 400 articles, books, and reports cited in Planco's 'Survey of the Research into Energy-Economy Interactions: Volume I are reported'. It represents the end result of a search for recent (1960 to present) and ongoing research into energy-economy interactions. Only the research directly related to macroeconomic energy-economy interactions was selected for inclusion in the annotated bibliography. Abstracts are provided. DOE

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-17910# Committee on Commerce, Science, and Transportation (U. S. Senate).

NASA AUTHORIZATION FOR FISCAL YEAR 1981, PART 1

Washington GPO 1980 798 p refs Hearings on S. 2240 before the Comm. on Commerce, Sci., and Transportation, 96th Congr., 2d Sess., 1980
(GPO-57-406) Avail: Comm. on Commerce, Sci., and Transportation

Highlights of NASA programs are presented along with justifications for a proposed budget of $5,736.7 million for research and development, research and program management, and construction of facilities. A supplemental budget for the space shuttle program is included. A.R.H.

N80-17911# Committee on Commerce, Science, and Transportation (U. S. Senate).

NASA SUPPLEMENTAL AUTHORIZATION FOR FISCAL YEAR 1979

Washington GPO 1979 10 p Report on H.R. 1787 of the Comm. on Commerce, Sci., and Transportation, 96th Congr., 1st Sess., 10 May 1979
(S-Rept-96-128; GPO-39-010) Avail: U.S. Capitol, Senate Document Room

A bill is presented which authorizes the appropriation of $185 million in additional funds to NASA for FY 1979 to be used for space shuttle orbiter production activities. The funding requirement is not due to any single program element, but to several items including the orbiter, main engines, solid rocket boosters, external tank, and thermal protection system. A.R.H.

N80-17912# Committee on Commerce, Science, and Transportation (U. S. Senate).
PATENT POLICY, PART 1
Washington GPO 1979 461 p refs Hearings on S. 1215 before the Subcomm. on Sci., Technol., and Space of the Comm. on Commerce, Sci., and Transportation, 96th Congr., 1st Sess., 23 and 27 Jul.; 25 Oct. 1979
(GPO-52-476) Avail: Subcomm. on Sci., Technol., and Space

Federal patent policies which were originally designed to protect the public interest by preventing the so-called give away, have operated to discharge contractor bidding thus eliminating incentives to innovate or disclose new ideas, and to delay the commercialization of inventions developed under Federal contract. A bill is presented and discussed, which will establish and maintain a Federally policy for the management and use of the results of government funded science and technology research and development. A.R.H.

N80-17913# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1981, PROGRAM REVIEW, VOLUME 1
Washington GPO 1979 649 p refs Hearings before the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., 16-18 Oct. 1979
(GPO-53-814) Avail: Subcomm. on Space Sci. and Applications

The status of NASA programs is reviewed as a preliminary to fiscal 1981 authorization hearings. Problems of cost, performance, and scheduling which can affect the budget program performance are examined. Particular emphasis is given to advanced research and development, technology utilization, and aerospace technology transfer in communications, space processing, energy conversion, electric propulsion systems, life sciences, planetary exploration, astrophysics, solar terrestrial interactions, and Earth resources observation. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N80-17914 Stanford Univ., Calif.
THE USE OF THE MACROANALYTIC MODELS FOR TRANSIT PLANNING IN SUBURBAN AREAS Ph.D. Thesis
Wei-Yue Lim 1979 241 p
Avail: Univ. Microfilms Order No. 8001960

The use of macroanalytic models to form the basis for transit planning in suburban areas is discussed. The framework developed for using these models for planning consists basically of three steps: (1) the development of performance charts for fixed route and dial-a-ride service using transit supply relationships; (2) the incorporation of demand models with supply models to form a supply-demand equilibrium model; and (3) the use of macroanalytic models for the partial optimization of transit designs in the presence of multiple conflicting performance criteria.
Dissert. Abstr.

N80-17915# Committee on Commerce, Science, and Transportation (U. S. Senate).
NATIONAL TECHNOLOGY INNOVATION ACT
Washington GPO 1979 432 p refs Hearings on S. 1250 before the Subcomm. on Sci., Technol., and Space of the Comm. on Commerce, Sci., and Transportation, 96th Congr., 1st Sess., 21, 27 Jun. and 21 Nov. 1979
(GPO-50-438) Avail: Subcomm. on Sci., Technol., and Space

The status of industrial innovation in the United States is reviewed, and the provisions of a bill to establish centers for industrial technology where universities and industries can collaborate in the generation of new ideas for technology are discussed. The proposed Office for Industrial Technology within the Department of Commerce, will (1) oversee the relation between technology and the economic and social well being of the country; (2) provide data, analysis, and judgement necessary to enhance the development of technology and innovation; and (3) support the technology broadly applicable to industrial development. A.R.H.

N80-17916*# Garrett Corp., Torrance, Calif.
ADVANCED ELECTRIC PROPULSION SYSTEM CONCEPT FOR ELECTRIC VEHICLES
A. E. Raynard and F. E. Forbes Aug. 1979 157 p refs
(Contracts EC-77-A-31-1044; DEN3-81)
(NASA-CR-159651; DOE/NASA/0081-79/1;
AiResearch-79-16182) Avail: NTIS HC A08/MF A01 CSCL 13F

Seventeen propulsion system concepts for electric vehicles were compared to determine the differences in components and battery pack to achieve the basic performance level. Design tradeoffs were made for selected configurations to find the optimum component characteristics required to meet all performance goals. The anticipated performance when using nickel-zinc batteries rather than the standard lead-acid batteries was also evaluated. The two systems selected for the final conceptual design studies included a system with a flywheel energy storage unit and a basic system that did not have a flywheel. The flywheel system meets the range requirement with either lead-acid or nickel-zinc batteries and also the acceleration of zero to 89 km/hr in 15 s. The basic system can also meet the required performance with a fully charged battery, but, when the battery approaches 20 to 30 percent depth of discharge, maximum acceleration capability gradually degrades. The flywheel system has an estimated life-cycle cost of $0.041/km using lead-acid batteries. The basic system has a life-cycle cost of $0.06/km. The basic system, using batteries meeting ISOA goals, would have a life-cycle cost of $0.043/km. A.R.H.

N80-17917*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ROADSIDE TREE/POLE CRASH BARRIER FIELD TESTS
A. H. Wilson 15 Nov. 1979 52 p refs
(Contract NAS7-100)
(NASA-CR-162788; JPL-Pub-79-114) Avail: NTIS HC A04/MF A01 CSCL 13F

A series of tests was carried out to evaluate the performance of a crash barrier designed to protect the occupants of an automobile from serious injury. The JPL barrier design is a configuration of empty aluminum beverage cans contained in a tear-resistant bag which, in turn, is encased in a collapsible container made of plywood and steel. Tests were conducted with a driven vehicle impacting the barrier. The basic requirements of NCHRP Report 153 were followed except that speeds of 30 mph rather than 60 mph were used. Accelerometer readings on the driver's helmet showed that the driver was never subjected to dangerous decelerations, and never experienced more than temporary discomfort. Also, all of the requirements of the cited report were met. An extrapolation of data indicated that the JPL barrier installed in front of a tree or telephone pole along a roadside would also have met the requirements at a speed of 40 mph. A.R.H.

N80-17918# EIC, Inc., Newton, Mass.
SURVEY ON METALLURGICAL RECYCLING PROCESSES Final Report
J. P. Pemsler Mar. 1979 197 p refs
(Contract W-31-109-eng-38)
(ANL/OEPM-79-2) Avail: NTIS HC A09/MF A01

Major opportunities for increasing the extent of recycle of nonferrous scrap metals and thereby increasing the energy savings are discussed. Preliminary flowsheets are presented for the recovery of value metals from batteries considered for use in vehicular propulsion and load leveling applications. A flow sheet was outlined for an integrated hydrometallurgical process to treat low-grade copper scrap. A fully integrated hydrometallurgical process is outlined, and costs and energy consumption are derived for recovering zinc metal from electric furnace flue dusts. Costs and energy are high and the process does not appear to warrant development at this time. Improvement in the recycle of magnesium is associated primarily with improved recycle in the Al industry where Mg is an important alloy additive. Ni and Ti recycle are associated with improved collection and sorting of stainless steel and specialty alloys. DOE

N80-17919# Booz-Allen and Hamilton, Inc., Bethesda, Md. Transportation Consulting Div.
LOW-FLOOR ARTICULATED BUS DEMONSTRATION Final Report
Sep. 1979 45 p
(Grant UMTA-9073-077)
(PB-300497/5; UMTA-MD-06-0024-79-1; BP-79-001) Avail: NTIS HC A03/MF A01 CSCL 13F

The stability and anti-jackknifing capabilities of a low-floor articulated bus are documented. Data on performance; reactions of drivers, maintenance and management personnel; and public relations demonstrate that the low-floor concept is an improvement over current articulated vehicle designs. The low floor allows faster and easier boarding, thus increasing productivity and offering an advantage to elderly and handicapped persons. GRA

N80-17920# Otis Elevator Co., Denver, Colo. Transportation Technology Div.
VEHICLE LONGITUDINAL CONTROL AND RELIABILITY PROJECT. VOLUME 5: VLCR ENTRAINMENT AND PLATOONING ANALYSIS AND DESIGN, PARTS A AND B Final Report
D. Lorenz Feb. 1979 534 p
(Contract DOT-UT-70048)
(PB-299798/9; OTIS/TTD/VLAC-058;
UMTA-IT-06-0148-79-5) Avail: NTIS HC A23/MF A01 CSCL 13F

Longitudinal control aspects of automatic entrainment and platooning concepts were studied in order to: (1) develop functional and performance specifications for longitudinal control systems for automated guideway transit systems using automatic entrainment or platooning; (2) evaluate an automatic coupling and decoupling system suitable for trained vehicle operation and failed vehicle pulling and pushing; (3) establish design concepts and specifications for automatic coupling systems which meet the requirements in a cost-effective manner; and (4) assess the platooning concept and establish platooned vehicle operation. GRA

N80-17921# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
OPERATION OF AUTOMATED GUIDEWAY TRANSIT VEHICLES IN DYNAMICALLY RECONFIGURED TRAINS AND PLATOONS - EXTENDED SUMMARY Final Report, Sep. 1976 - Dec. 1978
S. Shladover Apr. 1979 112 p refs
(Contracts MA-11-0029)
(PB-300513/9; UMTA-MA-06-0085-79-1) Avail: NTIS HC A06/MF A01 CSCL 13F

A broad-based preliminary evaluation of the potential advantages and disadvantages of an entrained automated guideway transit (AGT) system is presented. It includes an investigation of the applications for which entrained AGT is well suited, and an assessment of how much capacity improvement it can offer. The study shows that passenger capacity of AGT systems may be increased by operating vehicles in dynamically-reconfigured trains or platoons. It is estimated that a minimum lane capacity of 5,000 to 10,000 passengers per hour is needed to make single-party AGT economically competitive with buses and that this capacity requires the use of trains. The capacity advantage of entraining is demonstrated for a single guideway link and for merge junctions, using Monte Carlo simulation. GRA

N80-17922# Transportation Systems Center, Cambridge, Mass.
ANALYSIS OF LIFE-CYCLE COSTS AND MARKET APPLICATIONS OF FLYWHEEL ENERGY-STORAGE TRANSIT VEHICLES Final Report, Fall 1977 - Summer 1978
D. L. Goeddel and G. Ploetz Jul. 1979 191 p
(PB-300289/6; DOT-TSC-UMTA-78-77;
UMTA-MA-06-0044-78-2) Avail: NTIS HC A09/MF A01 CSCL 13F

The operational requirements and conceptual design of flywheel energy storage vehicles for transit service are analyzed along with the economic viability and potential market applications of these proposed concepts within urban transit operations. The design characteristics, system capital costs, and annual recurring operations/maintenance costs associated with the conventional diesel bus, the trolly bus, and the flywheel-powered vehicle systems are defined. The results of the life cycle analysis and the sensitivity of these results due to variations of key assumed input variables are described. GRA

N80-17923# Transportation Systems Center, Cambridge, Mass.
SIMULATION OF AN URBAN BATTERY BUS VEHICLE Final Report, Jun. - Dec. 1978
John J. Stickler Jul. 1979 90 p
(PB-300306/8; DOT-TSC-UMTA-79-15;
UMTA-MA-06-0093-79-1) Avail: NTIS HC A05/MF A01 CSCL 13F

The computer simulation of a battery-powered bus as it traverse an arbitrary mission profile of specified acceleration, roadway grade, and headwind is described. The battery-bus system components comprise a DC shunt motor, solidstate power conditioning unit with regeneration capability, and a battery source consisting of a multiunit lead acid battery. The computer model determines vehicle tractive effort and power consumption and computes actual vehicle speed for a given mission profile. The computer model uses a 'modularization' format which facilitates the simulation of alternate propulsion systems involving the interchange of one system component for another. GRA

N80-17924# Stanford Univ., Calif. Dept. of Civil Engineering.
DEVELOPMENT OF RESEARCH IN THE CONSTRUCTION OF TRANSPORTATION FACILITIES: A STUDY OF NEEDS, OBJECTIVES, RESOURCES, AND MECHANISMS FOR IMPLEMENTATION Final Report
John W. Fondahl and Boyd C. Paulson Aug. 1979 145 p refs
(Contract DOT-OS-60150)
(PB-301389/3; DOT/RSPA/DPB/50-79/12) Avail: NTIS HC A07/MF A01 CSCL 13B

The implementation of research results is discussed along with problems created by planning, design, and organizational decisions. Incentives and obstacles to research implementation are identified and proposals for more rapid and effective application of research results are made. Increased utilization of demonstration projects, bid alternates, turnkey contracts, and follow-up measures are discussed. A special study of measures by the Japanese construction industry to achieve cost reduction through innovation is included. Experience originating in projects such as BART, WMATA, and MARTA is examined to identify problems that have serious impact both on costs and the environment desirable for innovative efforts. GRA

N80-17925# M and I, Inc., Fort Collins, Colo.
EVALUATION OF OPERATION AND MAINTENANCE FACTORS LIMITING MUNICIPAL WASTEWATER TREATMENT PLANT PERFORMANCE Final Report
Bob A. Hegg, Kerwin L. Rakness, and James R. Schultz Jun. 1979 174 p refs
(Contract EPA-68-03-2224)
(PB-300331/6; EPA-600/2-79-034) Avail: NTIS HC A08/MF A01 CSCL 13B

A significant number of wastewater treatment plants constructed with Federal monies have not met design or permit standards. Comprehensive evaluation were conducted at thirty wastewater treatment facilities to identify, quantify and rank the causes of this poor performance. The two highest ranking factors identified were inadequate operator application of concepts and testing to process control and sewage treatment understanding. Many operators were not trained as evidenced by a lack of sewage treatment understanding, but even trained operators did not apply concepts of operation to process control. The third highest ranking factor identified was improper technical guidance from authoritative sources. Six of the ten highest ranking factors were related to improper plant design. GRA

N80-17926# M and I, Inc., Fort Collins, Colo.
A DEMONSTRATION APPROACH FOR IMPROVING PERFORMANCE AND RELIABILITY OF BIOLOGICAL

WASTEWATER TREATMENT PLANTS Final Report
Bob A. Hegg, Kerwin L. Rakness, and James R. Schultz Jun. 1979 64 p refs
(Contract EPA-68-03-2224)
(PB-300476/9; EPA-600/2-79-035) Avail: NTIS HC A04/MF A01 CSCL 13B

The factors limiting plant performance at thirty treatment facilities were examined and a method, Composite Correction Programs (CCP), of improving plant effluent quality was developed. A CCP was implemented at the Havre, Montana Wastewater Treatment Plant and a significant improvement in plant effluent resulted which allowed permit standards to be met consistently. The potential improvment in plant performance that could be achieved if CCP's were implemented at all thirty facilities evaluated was projected. The mass of BOD5 and TSS discharged to the receiving streams would be reduced by 490 metric tons/year and 470 metric tons/year, respectively. GRA

N80-17927# Wiss, Janney, Elstner and Associates, Inc., Northbrook, Ill.
CONTROL OF VIBRATION AND BLAST NOISE FROM SURFACE COAL MINING, VOLUME 3 Final Report, 1 Jul. 1975 - 28 Feb. 1979
John F. Wiss and Patrick W. Linehan Dec. 1978 626 p refs
(Contract J-0255022)
(PB-299889/6; BM-OFR-103(3)-79) Avail: NTIS HC A99/MF A01; also available in set of 4 reports HC E16 as PB-299886-SET CSCL 13F

The effects of blast parameters upon the ground and air vibration were studied. Results of a series of controlled experiments conducted at four surface coal mines are presented. Data from preliminary scale-model blasts conducted at a quarry are included. GRA

N80-17928# Boeing Vertol Co., Philadelphia, Pa. Surface Transportation Systems Dept.
SLRV (STANDARD LIGHT RAIL VEHICLE) ENGINEERING TESTS AT DEPARTMENT OF TRANSPORTATION, TRANSPORTATION TEST CENTER. VOLUME 1: INTRODUCTION Final Report, Jan. - Jun. 1976
Feb. 1979 74 p refs
(Contract DOT-TSC-1062)
(PB-301146/7; DOT-TSC-UMTA-79-27-Vol-1; UMTA-MA-06-0025-79-3-Vol-1) Avail: NTIS HC A04/MF A01; also available in set of 4 reports PC E10, PB-301145-SET CSCL 13F

Specifications were developed for an optimum light rail vehicle. The performance, power consumption, ride roughness, noise, and radio frequency interference tests carried out on production pilot cars are described and the results are summarized. K.L.

N80-17929# Boeing Vertol Co., Philadelphia, Pa. Surface Transportation Systems Dept.
SLRV (STANDARD LIGHT RAIL VEHICLE) ENGINEERING TESTS AT DEPARTMENT OF TRANSPORTATION, TRANSPORTATION TEST CENTER. VOLUME 2: PERFORMANCE AND POWER CONSUMPTION TESTS Final Report, Jan. - Jun. 1976
Feb. 1979 66 p refs
(Contract DOT-TSC-1062)
(PB-301147/5; DOT-TSC-UMTA-79-27-Vol-2; UMTA-MA-06-0025-79-4-Vol-2) Avail: NTIS HC A04/MF A01; also available in set of 4 reports PC E10, PB-301145-SET CSCL 13F

The results of acceleration, deceleration, traction resistance, spin/slide control system, and power consumption tests are presented. The tests are described in detail. K.L.

N80-17930# Boeing Vertol Co., Philadelphia, Pa. Surface Transportation Systems Dept.
SLRV (STANDARD LIGHT RAIL VEHICLE) ENGINEERING TESTS AT DEPARTMENT OF TRANSPORTATION, TRANSPORTATION TEST CENTER. VOLUME 3: RIDE QUALITY, NOISE, AND RADIO FREQUENCY INTERFERENCE TESTS Final Report, Jan. - Jun. 1976
Feb. 1979 178 p refs
(Contract DOT-TSC-1062)
(PB-301148/3; DOT-TSC-UMTA-79-27-Vol-3; UMTA-MA-06-0025-79-5-Vol-3) Avail: NTIS HC A09/MF A01; also available in set of 4 reports PC E10, PB-301145-SET CSCL 13F

Detailed descriptions and discussions of the engineering tests performed on samples of the SLRV are presented. GRA

N80-17931# Boeing Vertol Co., Philadelphia, Pa. Surface Transportation Systems Dept.
SLRV (STANDARD LIGHT RAIL VEHICLE) ENGINEERING TESTS AT DEPARTMENT OF TRANSPORTATION, TRANSPORTATION TEST CENTER. VOLUME 4: DATA LOGS Final Report, Jan. - Jun. 1976
Feb. 1979 67 p refs
(Contract DOT-TSC-1062)
(PB-201149/1; DOT-TSC-UMTA-79-27-Vol-4; UMTA-MA-06-0025-79-6-Vol-4) Avail: NTIS HC A04/MF A01; also available in set of 4 reports PC E10, PB-301145-SET CSCL 13F

The SLRV (Standard Light Rail Vehicle) is a 71-foot vehicle, articulated to negotiate curves down to a 32-foot radius and designed to operate at speeds up to 50 mph. Although the basic configuration and performance is standardized, the current operating properties (Massachusetts Bay Transportation Authority and San Francisco Municipal Railway) have specified individual requirements for auxiliary equipment and passenger accomodation. The results of the series of tests conducted to establish a baseline for the SLRV obtained in accordance with the General Vehicle Test Plans and to provide further experience in the use of the Test Plans in testing urban rail vehicles are presented. Performance power consumption, ride roughness, noise, and radio frequency interference are the topics covered. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-17932*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE X-RAY PULSARS 4U1145-61 AND 1E1145.1-6141
N. E. White, S. H. Pravdo, R. H. Becker, E. A. Boldt, S. S. Holt, and P. J. Serlemitsos Jan. 1980 16 p refs Submitted for publication
(NASA-TM-80636) Avail: NTIS HC A02/MF A01 CSCL 03A

Observations of the X-ray sources near 4U1145-61 are presented. The presence of two periodicities at 291 and 297 seconds is confirmed. The location of the shorter period is isolated to within 3 arc minutes of 4U1145-61. The spectrum of 4U1145-61 is a power law out to at least 60 keV with a 500 eV EW iron line at 6.7 keV. The inferred spectrum of the other is absorbed. No evidence is found for a monotonic variation in either pulse period. K.L.

N80-17933*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GSFC CONTRIBUTIONS TO THE NATO X-RAY ASTRONOMY INSTITUTE, ERICE, JULY 1979
S. S. Holt and R. F. Mushotzky Sep. 1979 47 p refs
(NASA-TM-80559) Avail: NTIS HC A03/MF A01 CSCL 03A

An overview of X-ray astronomical spectroscopy in general is presented and results obtained by HEAO 1 and 2 as well as earlier spacecraft are examined. Particular emphasis is given to the spectra of supernova remnants; galactic binary X-ray sources.

cataclysmic variables, bulges, pulsars, and stars; the active nuclei of Seyfert 1 galaxy, BL Lac, and quasars; the diffuse X-ray background; and galactic clusters. A.R.H.

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-17934 Cincinnati Univ., Ohio.
SOME PROPERTIES OF SPATIALLY HOMOGENEOUS SPACETIMES Ph.D. Thesis
Grant Colin Coomer 1979 133 p
Avail: Univ. Microfilms Order No. 8002428

The gravitational instability theory of galaxy formation is investigated for a viscous fluid and for a charged, conducting fluid with a magnetic field added as a perturbation. It is found that the growth rate of density perturbations in both cases is lower than in the perfect fluid case. The initial value problem for a viscous fluid with heat conductivity is also discussed. Spatially homogeneous but nonisotropic spacetimes are investigated. Two perfect fluid solution of Einstein's field equations are found which have spacelike hypersurfaces with Bianchi type II geometry. An expression for the spectrum of the cosmic microwave background radiation in a spatially homogeneous but nonisotropic universe is found and then used to determine the angular distribution of the intensity of the radiation in the simpler of the two solutions. When accepted values of the matter density and decoupling temperature are inserted into this solution, values for the age of the universe and the time of decoupling are obtained which agree reasonably well with the values of the standard model of the universe. Dissert. Abstr.

N80-17935 Texas Univ. at Austin.
A STUDY OF INTERSTELLAR DARK CLOUDS Ph.D. Thesis
Ronald Lee Snell 1979 287 p
Avail: Univ. Microfilms Order No. 7928359

An investigation of the physical and chemical properties of nine interstellar dark clouds is reported. The observations were compared with theoretical models of the line emission and absorption from the clouds to derive the fundamental physical parameters. The temperatures, densities, masses, and abundances of atomic and molecular species were determined in the nine dark clouds. The kinetic temperatures of the dense regions of the clouds were examined. The extended CO emission in the clouds and the decreasing densities in the outer regions of the clouds are discussed. Dissert. Abstr.

N80-17936 Institut d'Aeronomie Spatiale de Belgique, Brussels.
INTERPLANETARY SPACE: BIBLIOGRAPHY, FASCICLE 15
1978 154 p refs
Avail: Issuing Activity

This bibliography cites 786 reports from international literature concerning interplanetary space in the solar system. Subjects covered include the Moon; Venus; Mars; Jupiter and its satellites; Mercury; Saturn and its satellites; Pluto; Neptune, and Uranus; and meteors; cosmic rays; gravitation; and the structure of interplanetary space. Author (ESA)

N80-17937*# Wisconsin Univ. - Madison. Dept. of Physics.
SPATIAL DISTRIBUTION AND BROAD-BAND SPECTRAL CHARACTERISTICS OF THE DIFFUSE X-RAY BACKGROUND, 0.1 - 1.0 keV
D. McCammon, W. L. Kraushaar, W. T. Sanders, and D. N. Burrows Aug. 1979 11 p refs Presented at 16th Intern. Cosmic Ray Conf., Kyoto, Aug. 1979
(Grant NGL-50-002-044)
(NASA-CR-162763; No-102) Avail: NTIS HC A02/MF A01 CSCL 03B

Preliminary maps covering more than 85 percent of the sky are presented for three energy bands: the B band, the C band, and the M band. The study was undertaken to find evidence that most of the diffuse X-ray background at energies less than 1 keV is local to the galaxy and that it is most probably due to thermal radiation from a low density plasma which fills a substantial fraction of interstellar space. A preliminary analysis of the data is provided including a report that most of the B and C band flux has a common origin, probably in a 10 to the 6th power K region surrounding the Sun, and that most of the M band flux does not originate from the same material. A.W.H.

N80-17938*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE PENROSE PHOTOPRODUCTION SCENARIO FOR NGC 4151: A BLACK HOLE GAMMA-RAY EMISSION MECHANISM FOR ACTIVE GALACTIC NUCLEI AND SEYFERT GALAXIES
Darryl Leiter Dec. 1979 33 p refs Submitted for publication
(NASA-TM-80624) Avail: NTIS HC A02/MF A01 CSCL 03B

A consistent theoretical interpretation is given for the suggestion that a steepening of the spectrum between X-ray and gamma ray energies may be a general, gamma-ray characteristic of Seyfert galaxies, if the diffuse gamma ray spectrum is considered to be a superposition of unresolved contributions, from one or more classes of extragalactic objects. In the case of NGC 4151, the dominant process is shown to be Penrose Compton scattering in the ergosphere of a Kerr black hole, assumed to exist in the Seyfert's active galactic nucleus. A.R.H.

N80-17939*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE PHYSICAL ENVIRONMENT IN THE GALACTIC NUCLEI Ph.D. Thesis - Maryland Univ.
James Howard Beall Sep. 1979 190 p refs
(Contract NGL-21-002-033)
(NASA-TM-80569) Avail: NTIS HC A09/MF A01 CSCL 03B

Galactic nuclei and quasars emit radiation over the entire electromagnetic spectrum. This suggests that concurrent observations over a wide frequency range may provide useful information in determining appropriate models for the physical environment in which the radiation is produced. In conjunction with observations by the high energy spectrometer on OSO-8, four sources have been studied in this manner; the nucleus of the elliptical galaxy, Centaurus A (NGG 5128); the quasar, 30273; the Seyfert galaxy, NGC 4151 and the nucleus of the Milky Way (GCX). Concurrent observations are used to construct the composite spectra (from radio to X-ray) for Cen A and NGC 4151 while the composite spectra of 30273 and GCX are derived from the OSO-8 data and from other observers. A skymap technique used to analyze observations of the galactic center region yielded data consistent with a significant, hard X-ray source at the radio and infrared position of the nucleus of the Milky Way. A theoretical analysis of the temporal variability of the Cen A data is undertaken and its implications discussed. Similarities between the composite spectra of the observed sources suggest that radio-bright and radio-quiet quasars may represent the emission from galactic nuclei with elliptical and Seyfert-like morphologies, respectively. A.R.H.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-17940*# National Aeronautics and Space Administration, Washington, D. C.
MARS: THE VIKING DISCOVERIES
Bevan M. French Oct. 1977 37 p Original contains color illustrations
(NASA-EP-146) Avail: NTIS MF A01; SOD HC CSCL 03B

An overview of the Viking Mars probe is presented. The Viking spacecraft is described and a brief history of the earlier observations and exploration of Mars is provided. A number of the Viking photographs of the Martian surface are presented and a discussion of the experiments Viking performed including a confirmation of the general theory of relativity are reported. Martian surface chemistry is discussed and experiments to study the weather on Mars are reported. A.W.H.

N80-17941*# California Inst. of Tech., Pasadena. Div. of Geological and Planetary Sciences.
ANALYSIS OF VIKING INFRARED THERMAL MAPPING DATA OF MARS. THE EFFECTS OF NON-IDEAL SURFACES ON THE DERIVED THERMAL PROPERTIES OF MARS Final Technical Report, 1 Oct. 1978 - 30 Sep. 1979
Duane O. Muhleman and Bruce M. Jakosky Sep. 1979 56 p refs Submitted for publication
(Grant NsG-7565)
(NASA-CR-162782; Contrib-3228) Avail: NTIS HC A04/MF A01 CSCL 03B

The thermal intertia of the surface of Mars varies spatially by a factor of eight. This is attributable to changes in the average particle size of the fine material, the surface elevation, the atmospheric opacity due to dust, and the fraction of the surface covered by rocks and fine material. The effects of these non-ideal properties on the surface temperatures and derived thermal inertias are modeled, along with the the effects of slopes, CO2 condensed onto the surface, and layering of fine material upon solid rock. The non-ideal models are capable of producing thermal behavior similar to that observed by the Viking Infrared Thermal Mapper, including a morning delay in the post-dawn temperature rise and an enhanced cooling in the afternoon relative to any ideal, homogeneous model. The enhanced afternoon cooling observed at the Viking-1 landing site is reproduced by the non-ideal models while that atop Arsia Mons volcano is not, but may be attributed to the observing geometry. Author

N80-17942# National Technical Information Service, Springfield, Va.
MARS ENVIRONMENT. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1971 - Sep. 1979
Audrey S. Hundemann Sep. 1979 265 p Supersedes NTIS/PS-78/0940; NTIS/PS-77/0863; NTIS/PS-76/0841; NTIS/PS-75/752; NTIS/PS-75/031
(NTIS/PS-79/0974/0; NTIS/PS-78/0940; NTIS/PS-77/0863; NTIS/PS-76/0841; NTIS/PS-75/752; NTIS/PS-75/031) Avail: NTIS HC $30.00/MF $30.00 CSCL 03B

Research dealing with atmospheric and surface properties of Mars is discussed. A few abstracts pertain to instrumentation used in the space exploration. This updated bibliography contains 257 abstracts, 18 of which are new entries to the previous edition. GRA

N80-17943*# National Center for Atmospheric Research, Boulder, Colo.
CONVECTION IN ROTATING LAYERS WITH THERMAL WINDS AND APPLICATION TO JUPITER
David H. Hathaway 9 May 1979 153 p refs
(Contract NAS8-31958; Grants NGL-06-003-057; NSF ATM-77-23757)
(NASA-CR-162476; PB-301336/4; NCAR-CT-53) Avail: NTIS HC A08/MF A01 CSCL 03B

A linear stability analysis is carried out for fluid layers under uniform rotation which possess both vertical and horizontal temperature gradients. In order to represent various latitudes with these plane parallel layers, a rotation vector is used which is generally oblique to gravity. The preferred convective modes are assessed as a function of latitude for both ideal and real fluid. It is found that the diffusive effects of viscosity and thermal conductivity are relatively unimportant in determining the preferred orienation of these conective rolls. It is proposed that the axisymmetric cloud hands observed on the planet Jupiter may be produced by these east-west convective instabilities. A simple radiative-convective model for Jupiter is used to estimate the parameter values relevant in the stability analysis. GRA

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-17944*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STUDY OF THE SOLAR CYCLE FROM SPACE
Feb. 1980 366 p refs Symp. held at Wellesley, Mass., 14-15 Jun. 1979; sponsored in part by Am. Astron. Soc.
(NASA-CP-2098; Rept-7801) Avail: NTIS HC A16/MF A01 CSCL 03B

The objectives of and benefits to be derived from a program of solar cycle research are discussed with emphasis on the role space observations will play in this venture. The strategy to be employed in the coming decade is considered as well as crucial missions, experiments, and the theoretical advances required. For individual titles, see N80-17945 through N80-17968.

N80-17945*# High Altitude Observatory, Boulder, Colo.
DYNAMICS OF THE SOLAR INTERIOR AND THE SOLAR DYNAMO
Peter A. Gilman *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 3-11 (For primary document see N80-17944 08-92)
Avail: NTIS HC A16/MF A01 CSCL 03B

The solar convection zone is the origin of most of the variations in solar output observed or suspected to occur. The Sun's magnetic field is rooted there, and solar activity and the solar cycle are generated and maintained there. Changes in the magnetic fields which reach into the solar atmosphere and beyond to interplanetary space are largely determined by the dynamo action of velocity fields in the convection zone. If changes in solar luminosity occur on time scales of months to millenia, such changes probably have their origin in the changing dynamics of the convection zone, either as cause of or in response to long term changes in the level of solar activity. Fluctuations would occur in the rate at which energy is brought to the surface by convection, and the solar diameter would be slightly modified. To describe and ultimately understand the global workings of the solar dynamo requires simultaneous high quality photospheric observations of solar velocities, magnetic fields, intensity patterns, luminosity and various radiative outputs. The observations must be nearly continuous in time and of long duration-most or all of a solar cycle. Such a measurement program should be a major part of the proposed Solar Cycle and Dynamics Mission. A.R.H.

N80-17946*# High Altitude Observatory, Boulder, Colo.
THE CORONA AND HELIOSPHERE
T. Holzer *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 13-25 (For primary document see N80-17944 08-92)
Avail: NTIS HC A16/MF A01 CSCL 03B

The eleven-year solar cycle is an especially appropriate period over which to study the solar output and its variation, because during this cycle most of the important types of solar variability (many characterized by periods shorter than eleven years) are manifested. Studies of solar variability over a solar cycle will improve understanding of solar structure and of the generation of the solar wind, and this improved understanding can be useful in the related studies of stellar structure and stellar winds, since stellar observations are necessarily less detailed and sophisticated than are solar observations. A particularly significant benefit that will accrue from a thorough study of the solar atmosphere and its variability over the next solar cycle is a great enhancement in the usefulness of so-called 'proxy' data in studying longer term solar variations and their terrestrial implication. A.R.H.

N80-17947*# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
OVERVIEW ON THE STUDY OF THE SOLAR CYCLE FROM SPACE
Robert W. Noyes *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 31-42 (For primary document see N80-17944 08-92)
Avail: NTIS HC A16/MF A01 CSCL 03B

Recent insights into the workings of the solar system are reviewed as factors to be considered when formulating key questions to be answered during a large scale program to study the solar cycle. The main objectives of the Solar Cycle and Dynamics Mission are to determine the causes (physical origins and mechanisms) of the solar cycle and the effects of these mechanisms on the heliosphere, the vast region that includes the corona, interplanetary medium, and the terrestrial environment. The mission should be able to obtain synoptic data on solar variability associated with the cycle, and over at least a fraction of a single 11-year cycle. A.R.H.

N80-17948*# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.

A SOLAR ACTIVITY MONITORING PLATFORM FOR SCADM

Kenneth E. Kissell and David D. Ratcliff (Air Force Inst. of Tech.) *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 45-54 refs (For primary document see N80-17944 08-92)

Avail: NTIS HC A16/MF A01 CSCL 03B

The adaptation of proven space probe technology is proposed as a means of providing a solar activity monitoring platform which could be injected behind the Earth's orbital position to give 3 to 6 days advanced coverage of the solar phenomenon on the backside hemisphere before it rotates into view and affects terrestrial activities. The probe would provide some three dimensional discrimination within the ecliptic latitude. This relatively simple off-Earth probe could provide very high quality data to support the SCADM program, by transmitting both high resolution video data of the solar surface and such measurements of solar activity as particle, X-ray, ultraviolet, and radio emission fluxes. Topics covered include the orbit; constraints on the spacecraft; subsystems and their embodiments; optical imaging sensors and their operation; and the radiation-pressure attitude control system are described. The platform would be capable of mapping active regions on an hourly basis with one arc-second resolution. A.R.H.

N80-17949*# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.

PROBLEMS OF INTERIOR STRUCTURE, THE SOLAR DYNAMO AND THE ROLE OF SCADM IN PROVIDING INTERIOR DIAGNOSTICS

Nigel O. Weiss (Cambridge Univ.) *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 55-64 (For primary document see N80-17944 08-92)

Avail: NTIS HC A16/MF A01 CSCL 03B

What is already known about the structure of the Sun, the motion of its convective zone, and the solar cycle is reviewed. Topics discussed include solar variability, solar 'seismology', velocity patterns, magnetic fields, and the dynamo theory. Observations are needed to determine global properties (solar luminosity and radius), oscillations (p and g models), velocities (variation of rotation with time and depth), and magnetic fields. A.R.H.

N80-17950*# American Science and Engineering, Inc., Cambridge, Mass.

X-RAY BRIGHT POINTS AND THE SOLAR CYCLE DEPENDENCE OF EMERGING MAGNETIC FLUX

John M. Davis *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 65-73 refs (For primary document see N80-17944 08-92)

(Contracts NAS2-8683; NAS5-25496; NAS2-7758)

Avail: NTIS HC A16/MF A01 CSCL 03B

Soft X-ray imaging of the solar corona during the period 1970 to 1978 resulted in significant modifications to the view of the solar cycle with respect to both the properties of the large scale (coronal holes) and small scale (X-ray Bright Points) solar magnetic field. In the latter case, the particular contribution is to the emerging magnetic flux. Sounding rocket observations combined with the Skylab data indicate that the XBP are anticorrelated with sunspot number and are the dominant contributors to the solar cycle. A continuous data set covering a complete cycle would enable the validity of this result which has serious implications for the nature of the solar dynamo, to be confirmed. Author

N80-17951*# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.

X-RAY BRIGHT POINTS AND THE SOLAR CYCLE

L. Golub and G. S. Vaiana (Osservatorio Astronomico, Palermo, Italy) *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 75-83 refs (For primary document see N80-17944 08-92)

Avail: NTIS HC A16/MF A01 CSCL 03B

The shape of the Sun's activity spectrum is such that the majority of all magnetic flux emerging at the surface comes in the form of bright points, i.e., regions living less than two days. Examination of soft X-ray data obtained from 1970 to 1978 shows that the number of bright points appears to be anticorrelated with traditional activity indices, such as sunspot number; the anticorrelation persists after corrections are made for obscuration by active regions. Comparison of X-ray data with KPNO magnetograms shows that to within a factor of two, the average total amount of magnetic flux emerging over the full Sun is constant through the entire period of observation. The Solar cycle therefore appears to be more an oscillation in the wavenumber distribution of emerging flux than of the total quantity of magnetic flux produced. A.R.H.

N80-17952*# Boston Univ., Mass. Dept. of Astronomy.

OBSERVABLE SOLAR FEATURES WHICH PROVIDE CLUES TO THE STATE OF THE SOLAR DYNAMO

Kenneth H. Schatten *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 85-100 refs (For primary document see N80-17944 08-92)

Avail: NTIS HC A16/MF A01 CSCL 03B

Space experiments are suggested to better monitor the solar dynamo and solar luminosity variations. Polar and other magnetic fields, sunspots, coronal holes, filaments and other observable solar and solar wind phenomena can provide us with important links to test and discover physical mechanisms which relate solar activity to terrestrial weather, climate, and possibly population variations. Author

N80-17953*# High Altitude Observatory, Boulder, Colo.

THE OPPORTUNITIES OFFERED BY SCADM FOR THE STUDY OF SURFACE PHENOMENA RELATED TO INTERIOR STRUCTURE AND DYNAMICS

Timothy M. Brown *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 101-135 refs (For primary document see N80-17944 08-92)

Avail: NTIS HC A16/MF A01 CSCL 03B

The physical processes to be probed by experiments may be grouped as large scale flows, oscillations, and chromospheric/coronal diagnostics. While the fundamental concerns and observational equipments are similar within each class, different investigations may tell different things about the Sun. Observational requirements are listed for experiments to study (1) plasma-magnetic field interactions; (2) interior structure via oscillations; (3) chromospheric and coronal tracers; (4) rotation, meridional flows, and giant cells; (5) the depth dependence of rotation; (6) EUV luminosity; (7) intensity fluctuations and tracers; and (8) diameter oscillations. The effects of noise and timestring on experiment results are assessed. A.R.H.

N80-17954*# Arizona Univ., Tucson. Dept. of Physics.

SECOND GENERATION DETECTOR FOR LOW ORDER GLOBAL SOLAR OSCILLATIONS

F. F. Forbes, R. Bos, and H. A. Hill *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 137-146 refs Sponsored in part by NSF (For primary document see N80-17944 08-92)

Avail: NTIS HC A16/MF A01 CSCL 03B

The first observations of long period low order global solar oscillations grew out of diameter measurements made over an extended period of time. As a result of these investigations, a detailed understanding of the surface properties of the oscillations evolved, allowing development of a second generation detector. This new detector, currently under development directly utilizes various surface properties of the oscillations and does not, therefore, directly involve diameter measurements. The specifications of the detector, its supporting telescope and the observing program are reviewed. Author

N80-17955*# Aerospace Corp., Los Angeles, Calif. Space Sciences Lab.

THE MEASUREMENT OF GLOBAL SCALE SURFACE DYNAMICS

E. N. Frazier *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 147-157 refs (For primary document see N80-17944 08-92)
Avail: NTIS HC A16/MF A01 CSCL 03B

The SCADM mission implicitly contains a requirement for a fundamentally new type of satellite instrument: a very sensitive (approximately 1 m s/1) imaging velocity detector. This is needed to measure global oscillations and global circulation patterns, but the sensitivity requirement is so severe that it has not yet been met even with ground based instruments. In this presentation, the various possible sources of noise and other errors in such a device are considered, and the more detailed instrumental requirements are developed. This leads to the conceptual design of a velocitygraph that appears to achieve the necessary sensitivity and imaging capability within a resonable weight and volume.
Author

N80-17956*# California Univ. at Los Angeles. Dept. of Astronomy.

OBSERVATIONAL REQUIREMENTS FOR MEASUREMENTS OF SOLAR ROTATION INWARD TO THE BASE OF THE CONVECTION ZONE

Edward J. Rhodes, Jr. *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 159-173 refs (For primary document see N80-17944 08-92)
Avail: NTIS HC A16/MF A01 CSCL 03B

Measurements of the rate of rotation at various depths in the solar interior and of temporal changes in the rotation are discussed. A technique to measure the absolute rate of the Sun's rotation (in meters per second) below its visible surface over the outer 3% of its radius using ground based equipment is described. The theory of the technique, developed to the base of the solar convection zone is analyzed. It is stressed that such deeper rotational measurements, extending from 3% inward to 25 to 30% of the Sun's radius can only be obtained from a spaceborne instrument which is not subject to the normal Earth based day-night observing cycle. A.W.H.

N80-17957*# Stanford Univ., Calif. Inst. for Plasma Research.

A SUNSPOT PERIODICITY AND THE SOLAR ROTATION

J. W. Knight, P. A. Sturrock, and K. H. Schatten (Boston Univ., Mass.) *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 175-194 refs (For primary document see N80-17944 08-92)
(Grant NGL-05-020-272; Contract F19628-77-R-0310)
Avail: NTIS HC A16/MF A01 CSCL 03B

A least squares power spectrum analysis of daily sunspot numbers for the last 122 years yielded a statistically significant peak at 12.0715 plus or minus .002 days period. This feature at 11.685 days (sidereal) of the sunspot spectrum is discussed in relation to the peak at 12.22 days (sidereal) which Dicke found in his oblateness data. The data is attributed to the Sun's core if the core rotates at either 12.0715 days or 24.1430 days period (synodic). It is suggested that spacecraft observations combined with correlative analysis of solar surface features between eastern and western hemispheres could further reveal a basic core periodicity. A Dicke type space oblateness experiment is discussed for providing better photospheric observations than a ground instrument to determine the core periodicity. A.W.H.

N80-17958*# Los Alamos Scientific Lab., N. Mex.

SPATIAL EVOLUTION OF MAGNETIC FIELDS AS SEEN IN CORONAL STREAMERS TO 12 R SUB O DURING THE SOLAR CYCLE

C. F. Keller and W. Matuska *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 201-208 refs (For primary document see N80-17944 08-92)
Avail: NTIS HC A16/MF A01 CSCL 03B

Outer coronal photographs made from high altitude aircraft at the solar eclipses of 1966, '70, '72, '73., and '79 which sample various times in the solar cycle are presented. Coronal streamers extending from the solar limb to 12 R sub o are displayed. The evolution of the streamers as they distort magnetic field lines to large distances from the Sun is examined. Results show that the distortion is varied, that the polar plumes can be traced beyond 8 R sub o, diverging apparently along dipole field lines, and that the divergence varies along the solar cycle. Various changes in nonpolar streamers are discussed including the tendency to become radial beyond 3 to 5 R sub o as if controlled by the solar wind. A.W.H.

N80-17959*# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.

THE DEPENDENCE OF CORONAL HOLE SIZE ON LARGE SCALE MAGNETIC FIELD STRENGTH

Steven T. Suess and Richard S. Steinolfson (Alabama Univ., Huntsville) *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 209-217 refs (For primary document see N80-17944 08-92)
Avail: NTIS HC A16/MF A01 CSCL 03B

The importance of mathematical models of the coronal structure for studies of coronal energetics, to simulate global flows of the solar wind, and to obtain reliable solar terrestrial predictions is discussed. Previous coronal models, including an example of a coronal MHD flow model, are reviewed. The development of a coronal model which is a logical extension of earlier models and which allows a closer relationship to the photospheric magnetic field as it is observed daily is described. The calculations are outlined. The assumptions of the model are: axisymmetric flow with no rotation, resulting in two dimensional flow in a meridional plane; zero viscosity and infinite electrical conductivity; polytropic, single fluid flow; and no momentum addition. A.W.H.

N80-17960*# Naval Research Lab., Washington, D. C. Center for Space Research.

THE CONTRACTION AND DISAPPEARANCE OF THE POLAR CORONAL HOLES

N. R. Sheeley, Jr. *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 219-231 refs (For primary document see N80-17944 08-92)
(NASA Order W-14429)
Avail: NTIS HC A16/MF A01 CSCL 03B

He I 10830 A spectroheliograms obtained during 1974-1979 were used to study the evolution of the Sun's polar coronal holes. Synoptic polar plots show that the holes have decreased in size to the point that only vestigual holes remain and even these remnants fluctuate with detailed sunspot activity. A.W.H.

N80-17961*# California Univ. at San Diego, La Jolla. Dept. of Electrical Engineering and Computer Sciences.

SOLAR CYCLE CHANGES IN THE HIGH LATITUDE SOLAR WIND

B. J. Rickett and W. A. Coles *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 233-243 refs Submitted for publication (For primary document see N80-17944 08-92)
(Contract F19628-77-C-0161; Grant NSF ATM-78-06770)
Avail: NTIS HC A16/MF A01 CSCL 03B

Measurements of the solar wind velocity during the period 1971-79 using the technique of interplanetary scintillation are discussed. The average wind speed was faster than 500 km/s at latitudes above 30 deg for most of 1973-77. The fast polar stream, observed to become much narrower in 1978-79 is examined. The narrowing of the polar streams coincided with the emergence of sunspots at midlatitudes, with the start of the new solar cycle, and with a corresponding contraction of the polar coronal holes. The theory that the solar magnetic field controls the large scale structure of the solar wind is discussed in relation to the results. A.W.H.

N80-17962*# Los Alamos Scientific Lab., N. Mex.

AN IMAGING X-RAY SPECTROMETER TO STUDY SOLAR ACTIVITY IN CONJUNCTION WITH THE SCADM PROGRAM

Richard L. Blake *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 245-258 refs (For primary document see N80-17944 08-92)
Avail: NTIS HC A16/MF A01 CSCL 03B

An experiment is proposed to study solar active region dynamics and evolution. The experiment will employ an imaging

X-ray spectrometer to study solar activity in conjunction with the SCADM program. A summary of the experiment is presented which includes the specifications and capabilities of the X-ray spectrometer, the scientific objectives, the method of approach, and a comparison of the experiment with other solar X-ray experiments. The experiment is proposed for use on the space shuttle due to its larger volume and weight capacity. A.W.H.

N80-17963*# American Science and Engineering, Inc., Cambridge, Mass.

APPLICATION OF A MAGNETOGRAPH AND X-RAY TELESCOPE TO THE STUDY OF CORONAL STRUCTURE VARIATIONS

David M. Rust *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 259-263 refs (For primary document see N80-17944 08-92)
(Contract NAS8-27758)
Avail: NTIS HC A16/MF A01 CSCL 03B

The application of magnetographs and X-ray imaging techniques to determine the magnitude, structure, origin, and evolution of the solar coronal magnetic field is examined. The spatial and temporal resolution of the X-ray telescope is discussed and a comparison of ground based magnetogram sequences versus a magnetograph in space is presented. Skylab photographs of the evolution of transient coronal holes are provided. A.W.H.

N80-17964*# Boston Coll., Chestnut Hill, Mass. Dept. of Physics.

VARIATIONS OF THE SOLAR WIND AND SOLAR CYCLE IN THE LAST 300 YEARS

J. Feynman and S. Silverman (AFGL) *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 265-276 refs (For primary document see N80-17944 08-92)
(Contract F19628-79-C-0031)
Avail: NTIS HC A16/MF A01 CSCL 03B

The past history of the solar wind and solar cycle, inferred from records of geomagnetics and aurora, is examined. Records show that the solar wind apparently varied in a systematic manner throughout the period from 1770 to 1857 and that the period around 1810 resembled the 1901 minimum geomagnetic disturbance. Results show that the solar wind and hence the Sun changes on a time scale long compared to a solar cycle and short compared to the Maunder minimum. The inclusion of a study on the solar wind and solar cycle variations for the SCADM mission is discussed. A.W.H.

N80-17965*# New Hampshire Univ., Durham. Dept. of Physics.

CONTRIBUTIONS OF SCADM TO SOLAR-TERRESTRIAL PHYSICS

L. A. Fisk *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 277-289 refs (For primary document see N80-17944 08-92)
Avail: NTIS HC A16/MF A01 CSCL 03B

The many different aspects of solar terrestrial physics are summarized. The possible influence of variations in the solar outputs on the terrestrial climate, and the role for SCADM in such studies is emphasized. The use of SCADM to provide detailed information on variations in the solar outputs over a sizeable fraction of the solar cycle, and on the physics of the convection layer of the Sun is discussed. A.W.H.

N80-17966*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.

CONTROL OF THE EARTH'S ELECTRIC FIELD INTENSITY THROUGH SOLAR WIND MODULATION OF GALACTIC COSMIC RADIATION: SUPPORT FOR A PROPOSED ATMOSPHERIC ELECTRICAL SUN-WEATHER MECHANISM

Ralph Markson *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 p 291-313 refs (For primary document see N80-17944 08-92)
(Contract N00014-79-C-0399)
Avail: NTIS HC A16/MF A01 CSCL 03B

The ionospheric potential and galactic cosmic radiation, found to be inversely correlated with the solar wind velocity are examined as being germane to weather modification. Since the ionospheric potential is proportional to the fair weather electric field intensity and cosmic radiation is the dominant source of atmospheric ionization, it is concluded that the Earth's overall electric field varies in phase with atmospheric ionization and that the latter is modulated by the solar wind. A proposed mechanism, in which solar control of ionizing radiation influences atmospheric electrification and thus possibly cloud physical processes is discussed. An experimental approach to critically test the proposed mechanism through comparison of the temporal variation of the Earth's electric field with conditions in the interplanetary medium is outlined. A.W.H.

N80-17967*# New Mexico Univ., Albuquerque. Dept. of Physics and Astronomy.

CORONAL HOLES, SOLAR DIURNAL ANISOTROPY OF COSMIC RAYS AND OFF-ECLIPTIC INTERPLANETARY MAGNETIC FIELDS

H. S. Ahluwalia *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 10 p refs (For primary document see N80-17944 08-92)
(Grant NSF ATM-78-10727)
Avail: NTIS HC A16/MF A01 CSCL 03B

The information regarding the electromagnetic states of the interplanetary medium, derived from the analyses of the cosmic ray intensity variations observed with a global network of cosmic ray detectors such as neutron monitors and muon telescopes, is reviewed. The relation of the temporal characteristics of the cosmic ray solar diurnal anisotropy to the large scale characteristics of the interplanetary magnetic field, far away from the ecliptic plane, is addressed. A model for the phenomenon is described. A.W.H.

N80-17968*# Calgary Univ. (Alberta). Dept. of Physics.

SOLAR CORONAL HOLES AND COSMIC RAY INTENSITY VARIATIONS

D. Venkatesan, S. P. Agrawal (APS Univ., Rewa, India), L. J. Lanzerotti (Bell Telephone Labs., Inc., Murray Hill, N.J.), and R. T. Hansen (High Altitude Observatory) *In* NASA. Goddard Space Flight Center Study of the Solar Cycle from Space Feb. 1980 11 p refs (For primary document see N80-17944 08-92)
Avail: NTIS HC A16/MF A01 CSCL 03B

A relationship between the (North-South) asymmetry in the areas of the solar polar coronal holes and the (North-South) anisotropy in the cosmic ray intensity is examined. The investigation was extended over a period of two years, using ground based observations of coronal brightness obtained by the K-Coronameter. Periods for study of cosmic ray variations were chosen maximizing the asymmetry of the polar coronal holes. The importance of the role played by coronal holes in the solar modulation of galactic cosmic rays is emphasized. A.W.H.

N80-17969# Aerospace Corp., El Segundo, Calif. Lab. Operations.

CRLS-229 SOLAR X-RAY SPECTROMETER/SPECTROHELIOGRAPH EXPERIMENT Interim Report

P. B. Landecker, W. T. Chater, C. K. Howey, D. L. McKenzie, and H. R. Rugge Oct. 1979 207 p refs
(Contract F04701-79-C-0080)
(AD-A076255; TR-0080(5960-01)-1; SAMSO-TR-79-76) Avail: NTIS HC A10/MF A01 CSCL 03/2

The CRLS-229 Solar X-ray Spectrometer/Spectroheliograph was launched in the solar pointed section of the United States Air Force Space Test Program P78-1 satellite on 24 February 1979. The SOLEX collimated Bragg crystal spectrometer experiment and the MONEX solar X-ray monitor experiment were built by The Aerospace Corporation, and the Naval Research Laboratory supplied the SOLFLEX uncollimated solar flare crystal spectrometer and the MAGMAP magnesium mapping experiment. The SOLEX A spectrometer has a 20 arc sec multigrid collimator, an ADP or RAP crystal, and proportional counter detector with a 25 micrometers thick beryllium window. The SOLEX B spectrometer has a 60 arc sec collimator, an ADP or RAP crystal, and a channel electron multiplier array detector. The SOLEX crystals and detectors can be driven so that either spectrometer exposes RAP to the collimated solar X-rays while the other exposes ADP. The spacecraft pointing system can raster the SOLEX collimator over the whole sum or a 5 x 5 arc minute region to build up a monochromatic image, or it can point the instrument anywhere on the sun so that spectra in the 3-25 angstroms range are obtained. GRA

N80-17970# Institut fuer Weltraumforschung, Graz (Austria). Inst. fuer Meteorologie und Geophysik.

A STUDY OF HE SUPERPOSITION OF A CURRENT SHEET AND A DIPOLE FIELD [STIDIEN UBER DIE SUPERPOSITION VON STROMSCHICHT UND DIPOLFELDERN]

O. M. Burkard and H. Rucker Apr. 1978 39 p refs In GERMAN; ENGLISH summary

Avail: NTIS HC A03/MF A01

The interaction between the solar wind plasma and a planetary obstacle, e.g., the Earth's dipole field, is examined. The magnetic field structure of the Earth's dipole is analyzed for the case of an incomplete shielding. The physical quantities which are important in this context are modeled and studied. The principle mechanism of the model is seen as a relative motion between a current sheet and a magnetic dipole initiating a force at the charged particles within the conductive sheet. According to the dipole's position relative to the current sheet which is responsible for a current system and a sheet magnetic field. The superposition of these current sheets and dipole fields leads to magnetic field structures which are expected to be found around the subsolar magnetopause. Author (ESA)

N80-17971# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.

SOLAR-GEOPHYSICAL DATA NO. 420, AUGUST 1979. PART 1: PROMPT REPORTS Progress Report, Jun. - Jul. 1979

Helen E. Coffey, ed. Aug. 1979 170 p

(PB80-107097; SGD-420-Pt-1; NOAA-79092402) Avail: NTIS HC A08/MF A01 CSCL 03B

Data for July 1979 is provided on: alert periods, daily solar indices, solar flares, solar radio emission, spacecraft observations, coronal holes, solar wind measurements, inferred interplanetary magnetic field polarities, mean solar magnetic field, and Boulder Geomagnetic Substorm Log. Data is reported for June 1979 on: daily solar activity center, sudden ionospheric disturbances, solar X-ray radiation, solar radio emission, cosmic rays, geomagnetic indices, and radio propagation indices. GRA

N80-17972# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.

SOLAR GEOPHYSICAL DATA NO. 420, AUGUST 1979. PART 2: COMPREHENSIVE REPORTS Progress Report, Jan. - Feb. 1979

Helen E. Coffey, ed. Aug. 1979 125 p

(PB80-107105; SGD-420-Pt-2; NOAA-79092403) Avail: NTIS HC A06/MF A01 CSCL 03B

Data for February 1979 is provided on: active regions, synoptic solar maps, solar radio emission, energetic solar particles and plasma, and solar X-ray radiation. Synoptic charts and an abbreviated calendar record for January 1979 are included. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see 52 Aerospace Medicine. For theory see 73 Nuclear and High-Energy Physics.

N80-17973 California Univ., Santa Cruz.

INFRARED STUDIES OF LINE EMISSION IN COMPACT H 2 REGIONS Ph.D. Thesis

Daniel Fred Lester 1979 99 p

Avail: Univ. Microfilms Order No. 8002211

Observations of infrared emission lines are reported for the compact H II regions G29.9-0.0,G45.13 - 0.14A, W490H2, W511RS1 and IRS2, G75.84 - 0.4, S106A, W3IRS1 and IRS3, S156, Mon R2IRS1, K3-50A and the H 2 region at the galactic center Sgr A IRS1. Measurements of the fine structure lines of [NeII] 12.81 micron, [SIV] 10.51 micron and [ArIII] 8.99 micron are presented, along with measurements of the Br alpha 4.05 micron recombination line of ionized hydrogen. For several of the least obscured objects, measurements of [SIII] 9532A, R delta 10048A and HeI 10830A are reported. Dissert. Abstr.

N80-17974*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

X-RAY SPECTRUM OF KEPLER'S SNR

R. H. Becker, E. A. Boldt, S. S. Holt, P. J. Serlemitsos, and N. E. White Jan. 1980 11 p refs Submitted for publication

(NASA-TM-80637) Avail: NTIS HC A02/MF A01 CSCL 03B

Observations made with the solid state spectrometer aboard the Einstein Observatory confirm Kepler's SNR as an X-ray source with an intensity between 1-3 KeV of 7.2 x 10 to the-11th power ergs/sq cm-s. The X-ray spectrum is similar to those of Cas A and Tycho, with strong line emission from the helium-like species of Si, S, and Ar. Direct comparisons to Tycho's SNR suggest a distance of Kepler's SNR of greater than or equal to 5 kpc. Author

N80-17975*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE HIGH ENERGY X-RAY SPECTRUM OF 4U1700-37 OBSERVED FROM OSO-8

J. F. Dolan, M. J. Coe, C. J. Crannell, B. R. Dennis, K. J. Frost, G. S. Maurer, and L. E. Orwig Oct. 1979 24 p refs Submitted for publication

(NASA-TM-80583) Avail: NTIS HC A02/MF A01 CSCL 03B

The most intense hard X-ray source in the confused region in Scorpius is identified as 4U1700-37. The 3.4-day modulation is seen above 20 keV with the intensity during eclipse being consistent with zero flux. The photon-number spectrum from 20 to 150 keV is well represented by a single power law with a photo-number spectral index of -2.77 + or - 0.35 or by a thermal bremsstrahlung spectrum with kT = 27 96.8-min X-ray modulation previously reported at lower energies. Despite the difficulties in reconciling both the lack of periodic modulation in the emitted X-radiation and the orbital dynamics of the system with theories of the evolution and physical properties of neutron stars, the observed properties of 4U1700-37 are all consistent with the source being a spherically accreting neutron star rather than a black hole. K.L.

N80-17976*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SATELLITE OBSERVATIONS OF RAPIDLY VARYING COSMIC X-RAY SOURCES Ph.D. Thesis - Catholic Univ.

Gregory Scott Maurer May 1979 170 p refs

(NASA-TM-80285) Avail: NTIS HC A08/MF A01 CSCL 03B

The X-ray source data obtained with the high energy celestial X-ray detector on the Orbiting Solar Observatory -8 are presented. The results from the 1977 Crab observation show nonstatistical fluctuations in the pulsed emission and in the structure of the integrated pulse profile which cannot be attributed to any known systematic effect. The Hercules observations presented here provide information on three different aspects of the pulsed X-ray emission: the variation of pulsed flux as a function of the time from the beginning of the ON-state, the variation of pulsed flux as a function of binary phase, and the energy spectrum of the pulse emission. M.G.

N80-17977# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestische Physik.

DISCRETE GAMMA RAY SOURCES (E 30MeV)

V. Schoenfelder 1979 16 p refs

Avail: NTIS HC A02/MF A01

Low and medium energy gamma ray measurements between 0.5 and 30 MeV are reviewed. Results show that significant astrophysical phenomena are observable between X-ray energies and high energy gamma rays. Observations of galactic and extragalactic sources are summarized and future aspects are outlined. The development of extragalactic gamma ray astronomy is discussed for low gamma ray energies. Author (ESA)

99 GENERAL

N80-17978*# National Aeronautics and Space Administration, Washington, D. C.
THIS IS NASA
1979 53 p
(NASA-EP-155) Avail: NTIS MF A01; SOD HC as EP1.19:155 CSCL 05A

Highlights of NASA's first 20 years are described including the accomplishments of the National Advisory Committee for Aeronautics from its creation in 1915 until its absorption into NASA in 1958. Current and future activities are assessed in relation to the Federal R&D research plan for FY 1980 and to U.S. civil space policy. A NASA organization chart accompanies descriptions of the responsibilities of Headquarters, its various offices, and field installations. Directions are given for contacting the agency for business activities or contracting purposes; for obtaining educational publications and other media, and for tours. Manpower statistics are included with a list of career opportunities. Special emphasis is given to manned space flight, space launch vehicles, space shuttle, planetary exploration, and investigations of the stars and the solar system. A.R.H.

N80-17979# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
GENERAL PHYSICS, PLASMA DYNAMICS, AND COMMUNICATION SCIENCES AND ENGINEERING Annual Progress Report, 1 Jan. - 31 Dec. 1978
P. A. Wolff and J. Allen Jan. 1979 196 p refs
(Contract DAAG29-78-C-0020)
(AD-A076568; APR-121) Avail: NTIS HC A09/MF A01 CSCL 09/3

Progress is reported in the areas of general physics, plasma dynamics, and communication sciences and engineering. Topics covered include mic molecular microscopy, photoemission spectroscopy, interfacial chemistry, quantum electronics, radio astronomy, and electrodynamics. Digital signal processing, speech communication, and communications biophysics and neurophysiology are included. J.M.S.

N80-17980# Cambridge Univ. (England). Dept. of Engineering.
ACTIVITIES OF THE DEPARTMENT OF ENGINEERING FOR THE ACADEMIC YEAR 1977/1978 ***Annual Report***
W. A. Mair 1979 27 p refs
Avail: NTIS HC A03/MF A01

Activities reviewed include those related to acoustics; fluid mechanics; applied thermodynamics and turbomachinery; control, management systems, and computer aided design; electrical engineering, material sciences, soil mechanics, and the study of structures and their properties. Author (ESA)

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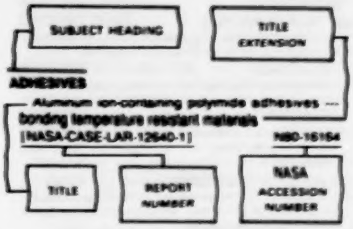
Typical Subject Index Listing



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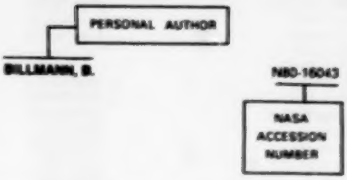

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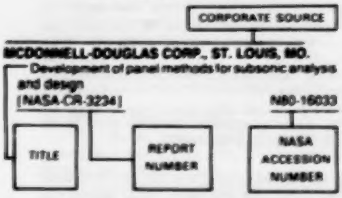
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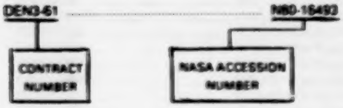

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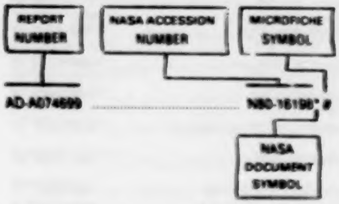

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